OREGON'S COMMERCIAL FORESTS

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OREGON STATE BOARD OF FORESTRY
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F. A. ELLIOTT, State Forester
Oregon's Commercial Forests

Their Importance to the State

by

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OREGON
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THE American nation has developed to such a degree that at last those who are concerned with the future of the country are forced to give serious consideration to the use of the nation's natural resources. This country has become great largely because nature placed within its limits a vast storehouse of materials peculiarly suited to man's use. This supply has been drawn upon recklessly. No real thought has been given to wise use or to the longest use of those resources which, from the very nature of the case, could not be renewed. Little consideration has been bestowed upon the wise use of those resources which, like the land, are capable of perpetual employment, or of the forests, which may be indefinitely renewed.

Public lands suited to agriculture are no longer available. There are no longer on the public domain, valuable stands of timber open to acquisition by private citizens. The needs of a growing population have forced all the better grades of agricultural land into private ownership and into tillage. The most valuable timber has either been harvested to meet the requirements of industry, or it has passed into the hands of owners who must soon market it in order to protect the investment which they have in it.

This nation has come squarely up to the problem of land use. Its continued and increasing greatness can only be guaranteed by better use of the land in all those ways in which it can be made to serve man's needs. The two principal uses to which land can be put are agriculture and forestry. Tremendous strides have been made in scientific agriculture in the past half-century. Millions in money have been expended in this field, and thousands of trained men have rendered splendid service in solving the problems of soil productiveness. The future food supply of a nation, twice as populous as the present, seems assured. A future wood supply, adequate for the needs of the great nation which this is destined to be, is not assured.

The serious factor in the forestry problem becomes evident when it is stated that a timber crop requires from fifty to one hundred years for maturity. When to this statement is added the assertions that this nation is using timber four times as fast as it is being produced; that by far the greater portion of the original stand of timber has been removed; and that in spite of substitutes for wood, the annual rate of timber consumption does not decrease, the seriousness of the
THREE FINGERED JACK FROM SQUAW LAKE
forestry problem becomes increasingly clear. A brief consideration of the progress of forest removal will aid in making clear Oregon's position in the forestry picture of the country.

**History of Forest Depletion**

When the first settlers landed upon the Atlantic seaboard, they found themselves confronted by what appeared to be an unbroken wilderness. As far as they were concerned, it was a limitless forest. It was forbidding and threatening. Beyond the borders of the wilderness lurked wild beasts and savage men. Added to this the trees combered the tillable soil from which the settlers must derive their food. Thus the forest was a real foe to their existence. That the forest supplied logs for their cabins, rails for their fences, and fuel for their fires was purely incidental in the conquest of the land for tillage. During more than the two centuries required to make the march of civilization from the Atlantic Coast to the Mississippi, the one great expenditure of human energy in winning the way was in conquering the forests, in felling the trees, burning all except what was needed for immediate use, and clearing the ground for cultivation.

These two centuries of forest destruction explain the development of that peculiar American mental attitude that a forest tree is of small importance, and that the forest is to be used or abused at the pleasure of the individual regardless of ownership. To change this mental attitude, in part only, has required more than thirty years of untiring effort on the part of those who have acquired an understanding of the economic significance of the forest resources to the future of the nation. Material progress has been made. The word "forestry" is no longer a stranger to the American people. There is a Federal Forest Service; many states have forestry organizations, and a few forward-looking private owners are beginning to think in terms of repeated timber crops.

Before the settler's ax had begun the removal of the forest to prepare the way for fertile fields, there was a forested area in the United States of about 850,000,000 acres. This vast timbered area has been reduced to less than 468,000,000 acres. More than half of this remaining area has been culled, or is unproductive. In a rough way there are five great forest regions in the United States. This separation of the original forested areas of the United States into regions is based largely upon distinctions of topography and upon the dominant species within the respective regions. It should be understood that certain species of trees appear in more than one region, and that there is no sharp dividing line between regions. In other words, this division into regional areas is largely for the pur-
pose of convenience in description. It should also be understood that in certain of these regions much of the timber has been removed to clear the land for cultivation, or else to supply the demands for lumber in the industries.

The Northern forests cover the northern portion of the Great Lakes region, New York, Pennsylvania, and New England. The white pine is the one tree quite generally distributed over this area. The eastern species of spruce, fir, hemlock, and cedar are among the commercially important trees while hardwoods form a decided mixture with the conifers in many places, especially in the southern portions of the region.

The Southern forests extend from Maryland along the coast to Texas, occupying the larger portion of each of the Gulf states, with the exception of Texas, the eastern portion only of this state being forested. The characteristic trees of the southern forest region are the small group from which the famous southern yellow pine is obtained.

The major portion of the Central Hardwood region lies in the Ohio valley, though broad arms extend along the Appalachian mountains, down into Arkansas, and up into Minnesota. This region is the home of the most valuable broad-leaf timber trees in the world. In this area grew the white oak, famous in furniture manufacture, black walnut, the hickories, maples, ashes, chestnuts, and others of less importance.

The Rocky mountain region, as the name indicates, covers roughly the great Rocky mountain territory. In the main the area is sparcely forested. It is rather distinctly divided into two parts. The northern division is characterized by the western yellow pine, lodgepole pine, Douglas fir, and Englemann spruce. The southern division has for its principal trees western yellow pine, juniper, pinon, with some Douglas fir and Englemann spruce.

The Pacific Coast forest occupies the territory west of the Sierra Nevada and Cascade mountains, and extends into eastern Washington, northern Idaho, and western Montana. This is the most densely forested area in the United States, and contains some of the largest and most valuable commercial trees in the world. The principal commercial trees of the region are Douglas fir, western red cedar, western hemlock, Sitka spruce, western white pine, redwood, and sugar pine.

**Progress of Forest Removal**

Oregon’s economic position with reference to the lumber industry and to a national and state forestry program will be better understood after brief consideration has been given to the progress of forest removal in the United States, and to the amount of standing timber which remains.
The great pine forests of New England and the Lake states are practically cut out. The remnants of these one-time splendid forests are being rapidly logged off from Maine to Minnesota. The northeastern United States, including New York, Pennsylvania, Delaware and New Jersey, now brings in from other forest regions about 80 per cent of all the timber it uses. Douglas fir from the Pacific northwest now dominates the New England market. The Lake states region, which, during the eighties and early nineties, supplied more than one-third of the lumber produced in the United States, now consumes 50 per cent more than it produces. The idle forest lands of the Lake states could produce more timber than the entire region consumes. The Southern yellow pine region for the past 15 years has been producing about 40 per cent of the lumber consumed in the United States. The South, however, is past the peak of production. Had it not been for the inferior second-growth stands, which have been cut far in advance of maturity, the South would have been decidedly below the Pacific Northwest as a lumber producing region. The time is not far distant when, like the Lake states and the Northeast, the South will be using all the lumber the region produces. The removal of some of the largest southern pine operators to the Pacific northwest is a sure indication that the end of the great lumber industry of the South is in sight.

The forests of the Rocky mountain area are widely scattered. Much of the timber is in comparatively inaccessible localities. With the growing development of this region, it is unlikely that, with the exception of Montana and Idaho, much more timber will be produced than will be required for local needs. The forests of the Pacific Coast region, including Montana and Idaho, carry a stand of 1,141,031,000,000 feet of saw-timber, an amount which represents more than one-half of the remaining saw-timber in the United States. This statement alone is sufficient to show that the Pacific Coast region is destined to be the great timber producing center of the United States.

Pacific Coast Forests

The stand carried by the Pacific Coast forests, as noted above, is 1,141,031,000,000 feet, board measure, of saw-timber. This immense volume of material is distributed as follows: Oregon, 395,800,000,000; California, 208,325,000,000; Washington, 282,250,000,000; Idaho, 81,300,000,000, and Montana, 50,010,000,000.

Douglas fir, one of the most valuable timber trees in the world, makes up more than one-half of the total timber stand of the Pacific Coast. The most recent estimate gives its
volume as 558,571,000,000 board feet. The following table, compiled by the Federal Forest Service,* indicates the approximate volumes in board feet of the various tree species of the Pacific Coast region:

<table>
<thead>
<tr>
<th>Tree Species</th>
<th>Volume (board feet)</th>
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<tr>
<td>Douglas fir</td>
<td>558,571,000,000</td>
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<tr>
<td>Western yellow pine and Jeffrey pine</td>
<td>183,453,000,000</td>
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<tr>
<td>Western hemlock</td>
<td>94,000,000,000</td>
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<tr>
<td>True firs</td>
<td>82,479,000,000</td>
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<td>72,208,000,000</td>
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<tr>
<td>Western white pine and sugar pine</td>
<td>88,485,000,000</td>
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<tr>
<td>Western red cedar</td>
<td>49,000,000,000</td>
</tr>
<tr>
<td>Lodgepole pine</td>
<td>4,566,000,000</td>
</tr>
<tr>
<td>Spruce</td>
<td>4,566,000,000</td>
</tr>
<tr>
<td>Other commercial species</td>
<td>44,914,000,000</td>
</tr>
<tr>
<td>Total</td>
<td>1,141,081,000,000</td>
</tr>
</tbody>
</table>

Oregon's Future as a Timber Producing State

The three Pacific Coast states carry over one-half of the remaining standing timber in the United States. Of these three states, Oregon has approximately 40 per cent more timber than Washington and an equal per cent more than California. Compared with the entire United States, Oregon has practically one-fifth of all the standing timber of the country. This vast stumpage resource, 396,000,000,000 feet, board measure, lies very largely west of the Cascade mountain divide. Under normal conditions, less than 1 per cent of this amount is being cut and marketed annually. Should this rate of cutting remain the same, it is evident that Oregon's timber industries could continue operating at the present rate for a hundred years. If this could be assured, the forestry problem, as far as Oregon is concerned, would not be a pressing one. Oregon, however, must play an increasingly important part in supplying the timber needs of the nation. In performing this proper economic function, it is evident that the rate at which the stumpage is being removed will greatly increase. There is no reason to assume that the history of the lumber industry in Oregon will differ materially from that of the other forested regions of the nation. In all cases the beginning was gradual. A crest in the wave of production was inevitably reached and as inevitably, an ebb followed, accompanied by all the economic and social disasters which trail a transitory industry.

The annual timber requirements of the United States approximate 40 billion feet, board measure. Close students of the entire situation do not believe that this annual requirement will be decreased. Wood is one of the great economic necessities. People will do without it for certain uses only under the pressure of extreme necessity. It is true that the

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per capita rate of wood consumption in the United States is decreasing. This is a natural sequence of the passing of the pioneer stage in national development, and with the approach to the maximum of regional economic development. In 1906, the per capita rate of wood consumption was 525 feet. In 1913 it had fallen to 430 feet, and in 1918, to 310 feet. War conditions and high prices no doubt contributed to the rapid decrease from 1913 to 1918. In 1925, the rate was 325 feet. 

Offsetting very largely the decline in per capita consumption is the rapid increase in population. While the average person is using less, the number of consumers is increasing at a sufficiently rapid rate to maintain the average annual rate of consumption for the entire nation. All this is proving out in spite of the many substitutes for wood. A forecast of lumber requirements in the United States is well stated in a recent report made to congress by the Federal Forest Service.

"The experience of industrial European countries gives some indication of what American future requirements for lumber will be. In England, for example, during the 60 years from 1851 to 1911, the consumption of lumber increased from
40 board feet to 120 board feet per capita, although 95 per cent of her requirements must be met through imports at high cost. Similarly, German home production at least doubled during the 60 years between 1840 and 1900. Industrial development made it necessary to import constantly increasing amounts of timber, and, in spite of the cost of imported material, the per capita consumption at the outbreak of the war was about 150 board feet per annum.

"The United States is still a new country. We still have large areas of undeveloped agricultural land. In much of our territory first construction was of such a character that replacement on a larger and better scale will be desirable if not absolutely necessary. Our population is growing rapidly and there is no reason to believe that it will not continue to grow. Industrial development in many sections has hardly begun. How large the per capita consumption in industrial centers is may be judged from the fact that in St. Louis the per capita consumption is over four times that for the entire country, in Pittsburgh three times, and in Chicago at least double."
“Even with large allowances for the substitution of other materials for timber, it seems hardly possible that our annual demand for lumber for years to come will fall below 35 billion feet. This is 5 billion less than the pre-war average of approximately 40 billion board feet. Even this will require a gradually reduced per capita consumption as population increases. For many years we shall find ourselves unable to satisfy our requirements with anything approaching the per capita consumption of either England or Germany. It follows that any future lumber production falling below approximately 35 billion feet, unless we can make up the difference by imports, will result in hardship to many classes of consumers and to many industries, like that experienced within the last year. Any such reduced consumption will unquestionably be the result of economic pressure from lumber shortages and high prices rather than of economic convenience. We have our warning in the present situation.”*

As has been indicated elsewhere, New England and the Lake states have ceased to be important factors in the lumber producing business. The South has passed the peak of its producing activity and some of the foresighted lumbermen, as well as forest experts, believe that in a few years it will cease to be an active competitor in the lumber producing game outside its own territory. The Rocky mountain forests, with the exception of those in Idaho and Montana, will not be able to supply any considerable amount of material for the great lumber markets of the country. The conclusion is inevitable that the Pacific Coast states will soon be called upon to supply a large portion of the timber required in the markets of the entire nation. Oregon is now the greatest timber state in the nation. In a few years it will be the most important lumber manufacturing state in the Union.

A PERPETUAL FOREST INDUSTRY IN OREGON

THE FOREST WEALTH of Oregon may be roughly divided into three parts. First, and fundamentally important, is the forest land; the land unsuited to agriculture and fitted to no other use than that of producing forest crops. Those who are concerned with the economic welfare of the state must think of forest land, whether it carries a stand of timber or not, as the real basis of a continuing forest industry. This land has produced one timber crop, and part of the crop has been harvested. Some of this cut-over land is entirely unproductive, while on some, nature, with considerable loss of time, is starting a new crop, which, like most volunteer crops, does not fully utilize the soil. The forest soils of the state should not be permitted to remain idle. The soil is potential forest wealth.

The immature, non-merchantable forest growth is the second main division of the forest wealth of the state. This second-growth material must be removed from the “brush” classification, a place which it still holds in the minds of too many people, and placed in the category of potential wealth. It is comparable to the farmer’s growing grain. The time element is the only difference.

The third great division of forest wealth is the mature timber. This has value for immediate conversion into manufactured lumber and other wood products in as far as it is accessible.

It must be evident to anyone that the land is basic for continued forest production in exactly the same sense as it is for continued wheat production. The forest is a crop. Man or nature sows the forest crop. It grows to maturity, and it is cut for man’s use. The soil is again released for a new crop. Because of the forest industry of the state, $110,000,000 is circulated annually through the various channels of business, and 47,000 workers find employment in it. Every economic consideration indicates that within a few years these figures will be greatly increased. If it is assumed that wood is one of the great human necessities, and if it is admitted that Oregon has within the limits of the state a vast area of land good for nothing except the growing of forest trees, and if, as is evident beyond question, manufacturing the product from this land can provide employment for thousands of laborers and can add millions of dollars to the wealth of the state, it seems reasonable that earnest consideration should be given to the perpetuation of an industry which can be made such a considerable factor in the industrial future of the state.
TWENTY YEARS AFTER LOGGING

Original slash burned and subsequent fires kept out. Note young growth coming in.
At the present time Oregon possesses certain unique advantages over any other state in the matter of insuring a perpetual timber supply. The state has a vast reservoir of mature timber; in fact, more merchantable timber than any other state in the Union. The state has an immense area of second growth in all stages of development. If protected from fire much of this material will be ready for the saw when the mature timber is gone. The younger stuff will mature at later intervals. Finally, the burned-over and cut-over land, if systematically planted up, will produce mature timber when the present second growth has matured and has been harvested. Of course the problem is not so simple of solution as these statements would make it appear. Nevertheless, the logic of the thing is evident and cannot be denied.

If the present rate of cut were to be maintained, it is evident that more than one hundred years would pass before the existing mature stand of timber would be cut off. Due to the depletion of timber supplies in other portions of the United States, as is pointed out elsewhere in this bulletin, timber requirements, which have been met in recent years very largely from the South, must soon come in rapidly increasing quantities from the Northwest. Everything considered, it appears safe to predict that privately owned timber in Oregon will be approaching exhaustion in twenty-five years, and considerable inroads will have been made in National Forest stumpage.

**Economic Value of Mature Stumpage**

It will be of interest to the citizens of Oregon to consider just what the logging, milling, and manufacture of this vast store of mature stumpage will mean, economically, to the state. Let it be assumed that, during the next 30 years, only 300 billion of the total of 395 billion feet of Oregon timber is cut. This will mean an average annual cut of 10 billion feet, an amount which is about two and one-half times the present annual cut. If $110,000,000 in wealth is now circulated yearly by the lumber industry throughout the state, an average of $275,000,000 will, during the 30-year period, be circulated annually through the state on account of the industry, and, on an average, 117,000 men will be employed by it. However, no one who has studied the economics of the lumber industry will admit for a moment that lumber prices will remain at the present level. This is the verdict of lumbermen, of economists, and of professional foresters generally. With the lessening of the timber supply, the price will certainly advance, and an amount far in excess of that indicated will annually be added to the wealth of the state. The purpose of presenting an illustration by means of these figures is to show the tre-
mendous active asset which the lumber industry is to the state, and to indicate the desirability of perpetuating it. The full force of the national demand for lumber from the stumpage supplies of the Pacific Northwest will not be felt until the southern pine, the chief competitor of Douglas fir, has been nearly exhausted. Economic factors indicate that during the next few years there will be a gradual increase in the demands made upon the Northwestern states for lumber, due to the gradual depletion of southern stumpage.

Second-growth in the Economic Scheme

At the present time Oregon has nearly 6,000,000 acres of second-growth timber in all stages of development, from very small stuff to that approaching maturity. Of this, an area of nearly 4,000,000 acres lies within the National Forests and is being managed for a future timber crop. If none of this second-growth were to be cut within twenty-five years, and then the present rate of cut, 100,000 acres per year, were to be maintained for the following 25 years, it is evident that no material under 50 years of age would need to be cut for the reason that logging could begin in what is now the oldest second-growth timber, much of which is now far in advance of 25 years. Investigations show that second-growth Douglas fir forests can produce an average of 36,000 board feet, board measure, per acre, in 60 years. Hemlock can easily produce an equal volume. Even a casual consideration of these figures, which should be thought of in connection with future increases in lumber prices, cannot fail to impress one with the great economic value to the state of the second-growth forests, and of the importance of seeing to it that these immature timber crops are brought to maturity.

The future of the area of second-growth in private ownership is uncertain due to excessive risk and unfavorable tax laws. With the privately owned stumpage as well as that publicly owned, the State is vitally concerned. It is a source of future wealth, and the responsibility rests upon the State to create those conditions which will insure the maturity of this growing crop.

Perpetual Forest Land Use

Thus far in the discussion of a perpetual forest industry an attempt has been made to show the part which the present stand of mature timber and second-growth, or immature forests, can play in bringing about that desirable end. The question must now be examined from the viewpoint of systematic forest replacement on cut-over, and burned-over forest land. Lumber manufacturing industries can not be maintained
unless a continued supply of raw material is available. Continued supplies will be available only under a definite and comprehensive system of forest management, including necessary forest planting, and adequate forest protection. By wise and careful use the present stands of mature and immature forest can be made to serve as a stop-gap between the present and the time, sixty years hence, when forests planted now will be ready for cutting.

Estimates made by the Federal Forest Service and the State Board of Forestry indicate that in the Douglas fir region of western Oregon, there is an area of at least 10,000,000 acres of land which is distinctly forest land. This land has no present, or prospective, agricultural value. Under management, this area should yield approximately 600 feet, board measure, per acre per year. In the yellow pine region there is an area of 5,000,000 acres of absolute forest land. The average annual growth rate on this land is estimated at 100 feet, board measure. In the Douglas fir region the average total annual production would be 6,000,000,000 feet, and in the yellow pine region 500,000,000, or a total production of 6,500,000,000 feet. This represents a volume of material more than twice that of the present average annual cut. By the most conservative estimates this will mean circulating annually through all the channels of trade in Oregon more than $150,000,000, and it will mean the permanent employment of more than 80,000 men. No patriotic citizen of Oregon can question the desirability of placing an industry of this magnitude upon a permanent footing.

From the figures given in the preceding paragraph, it appears that two-thirds of the acreage of the absolute forest land of the state lies west of the Cascades. On the basis of productive capacity, over 90 per cent lies west of the mountains. In other words, over 90 per cent of the total volume of timber will be produced on the west side when the present forest crop is cut and all the actual forest land is growing timber. The fact that this vast area of forest land of high productivity is thus located is decidedly fortunate, for the establishment of a new forest after the removal of the old is comparatively simple in this region. For the most part satisfactory reproduction will follow if the slash is burned in the spring, and fire is kept out thereafter. At the same time, the potential forest land which is not satisfactorily restocking should be systematically planted up. Just how, and when this big program is to be made effective, is a matter for future determination. The working out of the problem will require the best thought and active cooperation of many
### OREGON COMMERCIAL TIMBERLANDS

**1926**

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<td>1,294,000</td>
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<td>750,000</td>
<td>6,840</td>
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<tr>
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<td>30,670</td>
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<td>19,000,000</td>
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<td>1,560,000</td>
<td>378,756</td>
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<td>3,000,000</td>
<td>501,585</td>
<td>1,930,710</td>
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<tr>
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<td>4,000,000</td>
<td>1,121,169</td>
<td>2,461,980</td>
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<td>1,000,000</td>
<td>72,830</td>
<td>208,402</td>
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<td>12,850</td>
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<td>Yamhill</td>
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<td><strong>Totals</strong></td>
<td><strong>8,123,600</strong></td>
<td><strong>208,047,807</strong></td>
<td><strong>1,332,480</strong></td>
<td><strong>6,487,445</strong></td>
</tr>
</tbody>
</table>

**State lands**

- Warm Springs Indian reservation: 400,000
- Klamath Indian reservation: 800,000
- Umatilla Indian reservation: 11,000
- Crater national park: 100,000

**Grand totals**

- 24,051,111
- 396,067,694
people. One thing is certain: there must be a decided change in our attitude toward our timber resources. We have treated our forests as we would a mine. We have skinned out the timber as a miner would take out ore. When the usable timber had been taken out we have abandoned the works. We have ignored the fact that a tree grows, in the same sense that wheat grows. The forest is a renewable resource. In the interest of the nation and of the state, Oregon’s forests should be renewed; and, by all means, there should be as little delay as possible in making a beginning.

SECOND-GROWTH DOUGLAS FIR—OUR FUTURE TIMBER SUPPLY
DOUGLAS FIR

Pseudotsuga taxifolia (Poir.) Britt

Field Characteristics: Cones pendulous, two or four inches long, and with three pointed bracts extruded beyond the cone scale; leaves one inch long, neither grooved on surface nor notched at end, distributed in whorls on twigs rather than forming flat sprays; winter buds one-fourth inch long, slender, and pointed; bark soft in texture, easily cut with ax or knife, and, on mature trees, deeply furrowed.

DOUGLAS FIR, like its chief commercial rival, southern yellow pine, is known by a variety of colloquial names. Unlike the latter, it is represented by but one species, Pseudotsuga taxifolia. The names most commonly used, aside from that already mentioned, are: red fir, yellow fir, Douglas spruce, and Oregon pine. The name "Douglas fir" is the one recognized by the Federal Forest Service, and is especially appropriate because it honors the name of that hardy pioneer, David Douglas, who withstood the rigors of an unexplored country and, in 1827, made known to the world this tree which later was to play such an important part in the industrial development of America.

The exploitation of Douglas fir has progressed rapidly in the accessible regions of the Pacific Northwest. The bulk of the remaining timber of this species is in mature stands, where large veterans make up a dense forest. These mature trees are called yellow fir by the woodsmen because they produce lumber with a bright yellow hue which, on account of the slow growth of the tree, is very fine grained and relatively soft. The lumber from these mature "yellow fir" trees goes on the market as high-grade fir lumber. The bark on the old trees is heavily furrowed and very thick, frequently being 10 to 12 inches through; in fact, one specimen has been found with a bark thickness of 20 inches.

Where the ax of the lumberman or the ravages of fire, insects and diseases have interfered with the original forest, there frequently occur new even-aged stands of Douglas fir, popularly alluded to as "second-growth." The trees in these stands may be of any age up to 200 years and are characterized by a comparatively thin bark, usually not exceeding two inches in thickness, and not deeply fissured. Diameter and height growth has been rapid and a coarse-grained wood is produced which is hard and tough in texture and of a reddish color. These second-growth stands are so distinct from the mature forests of Douglas fir that the names "second-growth" and "red fir" have been commonly applied to them. These terms are also applied to the fuel and the lumber which is derived
from these immature stands. In contrast to second-growth the term "old-growth" is used with reference to the more mature stands, and is also commonly employed in connection with cordwood products derived from them. It is evident, then, that the trunks of these old trees may contain within their centers wood with characteristics of the red fir. This wood, of course, represents the result of the earlier growth. Thus red fir and yellow fir may be found in one and the same tree.
Two forms of Douglas fir are found; that growing in the Pacific states, and that native to the Rocky mountain region. Douglas fir is found growing over a wider area than that indicated by any other tree. It ranges from latitude 55 degrees north, in Canada, southward throughout the Coast, Cascade, Sierra and Rocky mountain regions, to latitude 23 north, and within these regions from the Pacific to the Continental divide. It is found from the sea level regions of Puget sound and the lower Columbia, to an elevation of 9,000 feet in the San Francisco mountains of northern Arizona. In many parts of this wide distribution it occurs in dense, pure stands, which are the result of fire, windfall, or some other factor of destruction to the preceding forest.

Trees of this species are frequently found reaching 250 feet in height and 5 feet in diameter. The maximum height recorded is 380 feet, which equals that of the redwood.* There is on record one tree which scaled 60,000 feet, board measure.† The average stand produces 35,000 to 60,000 feet, board measure, per acre, although as high a yield as 500,000 feet, board measure, has been obtained. The largest diameter on record is that of one which reached 17 feet at stump height.† The Oregon flag pole, a single fir stem erected at the Exposition grounds, San Francisco, measured 299 feet 7 inches in length.

Douglas fir occurs throughout the western part of the State of Oregon, with the exception of a few dry valleys, and grows from sea level to an elevation of 6,000 feet and sometimes as high as 7,200 feet. In the eastern part of the State, it extends up the Columbia river valley as far as Hood River. It is found east of Mt. Hood, but not beyond the Deschutes river, nor extending southward much beyond the town of Wapinitia. In southern Oregon it is common to the Coast, Umpqua, and Cascade mountains, but is not observed on the divide between the Deschutes and Klamath rivers.

The best development of Douglas fir is found in the coast region where there is an abundance of soil moisture. The tree is not exacting, however, and does well on a great variety of soils, including those of clay, gravel, and volcanic origin. In soils where the water table is low, the root system penetrates deep into the soil. It follows that trees of this character are relatively free from windfall. On alluvial soils, such as are common to the coast region, the roots grow close to the surface and spread themselves over great distances. It is here that windfall may occur because the roots do not have firm anchor-

* Frothingham, E. H.: Douglas Fir (U. S. For. Ser. Cir. 150, p. 28, 1909.)
age in the soil. In dense stands of this character the root systems of the respective trees come into close contact and often graft themselves together in a most interesting manner.*

On the best soils the growth of the little seedlings is rapid. They make on an average about four inches the first year, and more than twice this amount the second. When the trees become firmly established, at an age of six to ten years, annual leaders four feet in length are not uncommon. Both diameter and height growth continue to be relatively rapid during the first hundred years. The trees produce long, clear, straight boles where they grow in the denser forests, and a more rugged stem with excessive taper and carrying a full crown with great outstanding branches, where they grow in the open. In the coast forests the average age of the veteran trees is perhaps 400 years. Ring counts have been made on single stumps showing an age of more than 700 years, and it is not improbable that in exceptional cases this tree has reached a maximum age of 1,000 years.

Douglas fir, although growing most frequently in pure stands, associates with other species to some extent. It minglest most commonly with the western hemlock and western red cedar, which are found in the moist dark recesses of the coast forest, and with the tideland spruce along the coast. In the Sierras it is found in mixtures with sugar pine, western yellow pine and white fir. In the Rocky mountains the white and Alpine firs are frequently associated with it. Douglas fir is not very tolerant of shade. On the whole the associated species can endure more shade but the ability of the Douglas fir to grow in dense stands, provided there is top light, enables it to persist as the dominant tree of the forest.

The thick bark on matured trees is a great protection from fire. Whole forests may be observed where fire has killed every hemlock in a mixture of hemlock and fir, because of the thin bark of the hemlock and its more exposed root system, while the Douglas fir has not been seriously injured. Frequently, however, crown fires do considerable damage to Douglas fir, especially after a hot, dry season.

The most serious insect enemy of Douglas fir is the bark beetle (*Dendroctonus pseudotsugae*, Hopkins). This beetle works between the outer bark and the wood, thus ultimately girdling the tree. The larva of the Douglas fir pitch moth (*Sesia novaroensis* Hy. Edw.) also causes many defects ordinarily believed to be due to lightning, windshake, frost, blazes, and fires. Mistletoe (*Razoumofskya douglasii*, Engelm.) attacks the Douglas fir in some localities, and, by the develop-

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DOUGLAS FIR (Pseudotsuga taxifolia)

a. Fruiting branch showing pendent cone with extruded bracts.
b. Detail and arrangement of leaves and winter buds.
c. Matured cone with reflexed scales.
d. Outside of cone scale showing the slender acutely lobed and extended bract bearing a spear-like point in the notch.
e. Winged seed showing two sides.

(r indicates scale of reduction.)
ment of large brooms on the crowns of the trees, causes death. Perhaps the most frequent disease of the Douglas fir is the fungus commonly referred to as “punk” or “conch” and known technically as *Trametes pini*. This fungus probably causes four-fifths of the destruction brought about by the wood-destroying fungi of the United States.

Douglas fir produces large quantities of seed nearly every year, but at frequent intervals there occurs an especially large seed crop. Douglas fir has been observed producing an abundance of cones when only seven years of age. Mature, open-grown trees are especially prolific in seed production. The seed will not readily germinate on moist duff and litter such as are preferred by hemlock and cedar, but must have well-drained, bare, mineral soil, and no dense shade. Natural reproduction is abundant after fires. Seedlings are easily handled in seed beds, and are grown and used extensively by the Forest Service in its reforestation work. Foresters have demonstrated that the seed will retain its vitality for several years covered by the moist litter of the forest floor. This peculiarity of the tree is now recognized as of vital importance in the replacement of new stands on logged-off areas. If the slash from logging is burned the first spring following logging the fire is not severe enough to consume the seed stored in the lower portions of this ground cover. Accordingly dense stands of seedlings spring up after this slash fire, and the future forest is assured if the area is properly protected from fire thereafter.

It is interesting to note that trees grown from Douglas fir seed inherit the traits of the parent tree. The seeds collected in the coast region produce rapid-growing specimens capable of assuming enormous proportions, whereas seeds collected in the Rocky mountain region produce slow-growing trees sufficiently hardy to withstand the severe extremes of climate to which the parent tree has been subjected. Both forms have been grown in the mild climate of England and when growing in the same vicinity have afforded excellent comparison. In the eastern United States, only the Rocky mountain form can be grown successfully, because of the late frosts of the spring and early freezing weather in the fall.

It has been shown that the wood of Douglas fir varies with the age of the tree and the rate of growth. The “old-growth” yellow fir is sought after for “finish” lumber to be used upon the interior of residences. It is fine-grained, free from defect, and easy to work, making possible the beautiful panels used for walls and doors when the lumber is slash sawn. It is admirably adapted for use in ceiling, flooring, and partitions when quarter-sawn; in fact, more Douglas fir is used for general mill
work than the lumber industry employs from any other species. Douglas fir is supreme in the production of extra long, clear, straight-grained timbers for structural uses, such as bridges and general construction work. It is used more extensively than any other wood for tanks and silos and for wooden pipes. Its adaptability for ship building is so general that hulls of vessels constructed during the World war, even so far away as the New England states, were made of Douglas fir. In the absence of an available supply of spruce this reliable tree supplied a great proportion of aircraft woods used during the war for making wing-beams, longerons, struts, and engine bearers.

The closest competitor to Douglas fir in the distant markets is long-leaf pine (Pinus palustris, Mill.) a tree which is not only very limited in general range and local occurrence in a region where its exploitation is nearing completion, but one which is of slow growth and restricted in size to a maximum of 130 feet and a maximum diameter of 3 feet. These are facts which are of vital importance not only when the harvesting of the present stand of Douglas fir in the Pacific Northwest is considered, but also when one contemplates the growing of other crops of timber on the millions of acres of land in this region which is adapted only to forestry purposes.

It is estimated that the stand of Douglas fir in Pacific Coast states aggregates 558,000,000,000 feet. More than one-half of this amount is in Oregon. In 1925, the cut of Douglas fir in the United States was over eight billion feet. Of this amount, Oregon produced 34 per cent and Washington 60 per cent. The most active logging operations in Douglas fir in Oregon are in the lower Columbia, the Willamette valley, and the Coos Bay regions.
WESTERN YELLOW PINE

*Pinus ponderosa* Lawson

**FIELD CHARACTERISTICS:** Forest grown trees, clear, cylindrical trunks, open crowns. Open grown trees carry limbs close to ground. Bark of young trees, blackish with narrow furrows, on mature trees broad plates, russet-red. Leaves 3 in whorl, 4 to 11 inches long. Leaves fall about third year. Cones mature second season, 3 to 5 inches long, shiny, reddish brown when mature and fallen.

**WESTERN YELLOW PINE** has the distinction of being the most widely distributed of any member of the pine family. It extends from southern British Columbia south through the region west of the Rocky mountains to northern Mexico. In the north it breaks over the Continental divide as far east as the Black hills of South Dakota. In Washington and Oregon it is found chiefly east of the Cascades. In Oregon scattered stands are found in the lower valleys between the Cascades and the Coast range mountains. These stands become of minor commercial importance in Josephine and Jackson counties. The chief commercial stands of western yellow pine in Oregon are in the valley of the Deschutes river, in Klamath basin, and in northeastern Oregon.

This species endures a wider range of physical conditions than any other pine. It grows from sea level up to an elevation of 8,000 feet and from regions of high annual rainfall to those which are semi-desert. It is found on deep alluvial soil and endures in situations so rocky that there are barely enough crevices to give anchorage to the roots. A light, sandy, well-drained soil is needed for the best development of the tree. Its preference for sites of this character is indicated by the suddenness of its appearance east of the crest of the Cascade mountains.

Because of the high-grade material cut from mature western yellow pine, and because of an early prejudice against yellow pine and lumber, lumber cut from this species was put on the market under the trade name of western white pine. To avoid confusion with the true western white pine (*Pinus monticola*), lumber from the latter species goes to the trade quite generally as Idaho white pine. The trade name “pondosa pine” is coming into use in order to distinguish this species clearly from other pines.

The tree grows in stands which contain but a small percentage of other species. It is common to find in these nearly pure stands trees of matured growth mingling with bodies of younger timber. The younger stuff is frequently called “black jack” and “bull pine.” Bull pine is the name ordinarily applied to specimens with dark, rough bark and thick sapwood.
Oregon’s Commercial Forests

western yellow pine (Pinus ponderosa)

a. Detail of twig showing leaves, three in a bundle and with a persistent sheath at the base of each bundle.
b. Detached matured cone showing reflexed scales with heavy tips.
c. Sketch showing "broken cone" features.
d. Winged seed, both sides.
e. Seed without wing. (x indicates scale of reduction.)
Because of their moderate tolerance of shade, young trees do not thrive without top light and therefore the forest is open in character. The tree suffers serious injury through the attacks of insects, particularly those of the bark beetle. Since it is a prolific pitch producer, and because its bark is comparatively thin, there is much damage by fire. The name "cat face" is commonly used to designate the defect caused where ground fires have repeatedly burned at the base of the tree. It has been estimated that 40 per cent of the butt logs are fire scarred.

This tree attains a maximum size of 8 feet in diameter and 230 feet in height, and is known to have reached the age of 687 years. The average size of the mature trees in the commercial stands of Oregon is about 3½ feet in diameter and 110 feet in height. The bole of the tree is long, full, and clear, and in dense stands the crown is restricted to the upper one-third of the stem, but with open grown trees the crown extends down two-thirds of the trunk. The crowns of the young trees are decidedly conical, but as the tree advances in age and size it becomes open and rounded. The tops of matured trees have a tendency to flatten out. Yellow pine grows in mixtures with Douglas fir, white fir, sugar pine, lodgepole pine, larch, and incense cedar.

The total stand of Western Yellow pine is estimated to be approximately 250,000,000,000 feet, board measure. Recent Forest Service estimates indicate that about 75,000,000,000 feet of this amount is in Oregon. The average yellow pine stand runs about 7,000 board feet per acre. The 1926 cut of Western Yellow pine was 3,172,000,000 board feet, of which Oregon produced over one billion feet, more than 30 per cent of the total.

Klamath county has a stand of about 18 billion feet of yellow pine. Crook county has a stand of nearly 13 billion feet. Lake county has about 9 billion, Grant 8 billion, Jackson 5 billion, Wallowa 3 billion, and Baker 2.5 billion. Other counties carrying over a billion feet each are Wheeler, Harney, Union, Wasco and Josephine.

The wood of mature western yellow pine is fine grained, light, and with very little resin. It is a valuable wood for interior finish and makes excellent sash and doors. It is used extensively in the manufacture of boxes for shipment of fruits. Exposed to the weather or placed in contact with the soil it is not very durable. However, it takes paint well, and hence when painted is serviceable for siding and other exterior uses.

The important yellow-pine land of the State may be grouped into three sections: (1) The Blue Mountain region, embracing all the timbered land in the northeast quarter of the State, an
<table>
<thead>
<tr>
<th>County</th>
<th>Privately owned yellow-pine timberland</th>
<th>Government yellow-pine timberland</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Acres</td>
<td>Feet b.m.</td>
<td>Acres</td>
</tr>
<tr>
<td>Baker</td>
<td>213,168</td>
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<td>Crook</td>
<td>585,846</td>
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<td>Curry</td>
<td>59,520</td>
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<td>2,853,000,000</td>
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<td>Grant</td>
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<td>330,000,000</td>
<td>315,385</td>
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<td>Harney</td>
<td>6,000</td>
<td>18,000,000</td>
<td>4,000</td>
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<td>Hood River</td>
<td>592,751</td>
<td>5,481,000,000</td>
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<td>Lane</td>
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<td>Morrow</td>
<td>32,200</td>
<td>275,000,000</td>
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<tr>
<td>Umatilla</td>
<td>235,840</td>
<td>1,651,000,000</td>
<td>119,800</td>
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<td>Union</td>
<td>171,330</td>
<td>1,808,500,000</td>
<td>517,156</td>
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<td>Wallowa</td>
<td>40,000</td>
<td>280,000,000</td>
<td>145,000</td>
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<td>Wasco</td>
<td>198,875</td>
<td>1,586,000,000</td>
<td>101,690</td>
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<tr>
<td>Wheeler</td>
<td>40,000</td>
<td>280,000,000</td>
<td>145,000</td>
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<tr>
<td>Total</td>
<td>4,448,026</td>
<td>34,812,400,000</td>
<td>5,543,480</td>
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* All within the National Forests except that which is within the Klamath and Warm Springs Indian Reservations and the small amount owned by the state.
* Estimated; occurs as scattered trees.
* Estimated; occurs chiefly as scattered trees.

area that is practically surrounded by treeless country and to a large extent consists of rolling hills; (2) the Eastern Slope of the Cascades and their outstanding ranges, a zone of mountain tops and plateaus, which is bordered on the west by the summit of the range and on the east by desert, and on which yellow pine forms 80 per cent of all the commercial timber; (3) Southwestern Oregon, embracing the Siskiyou mountains and the western foothills and slopes of the Cascades south of the Umpqua river. The timber in these regions is distributed as follows:

<table>
<thead>
<tr>
<th>Regions</th>
<th>Acres of commercial yellow pine</th>
<th>Total stand in thousands of feet b. m.</th>
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<tr>
<td>Blue mountains</td>
<td>4,276,000</td>
<td>31,350,000</td>
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<tr>
<td>East Slope Cascades</td>
<td>3,400,000</td>
<td>33,185,000</td>
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<tr>
<td>Southwest Oregon</td>
<td>2,330,000</td>
<td>6,830,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>10,006,000</strong></td>
<td><strong>71,365,000</strong></td>
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</table>

Most of Oregon's 70,000,000,000 feet of yellow pine occurs in 10 counties, each of which has over 1,500,000,000 feet b. m. and 300,000 acres of commercial yellow-pine timberland. In the order of the volume of their standing yellow pine, the counties are thought to rank as follows: Klamath, Crook, Lake, Grant, Jackson, Wallowa, Baker, Wheeler, Harney, and Union. Table 1*, prepared in 1912 and 1913, indicates the acreage and amount of yellow pine in private and in government ownership for the counties in which it occurs in commercial quantities.

*From a compilation prepared largely by Forest Examiner R. M. Evans on the amount, distribution, and ownership of yellow pine in Oregon.
FIELD CHARACTERISTICS: Inclined to be limby except in dense stands. Shade enduring. Small branches pendulous. In young trees, top drooping; bark smooth, russet-brown. In mature trees, bark one to one and one-half inches thick, dark russet-brown, deeply furrowed. Leaves flat, rounded end, one-fourth to one inch long. Cones abundant, pendulous, three-fourths to one and one-fourth inches long. Seed small with comparatively large wing.

WESTERN HEMLOCK is one of the most valuable trees of the Pacific slope. It is found growing in dense stands throughout the region. The name “hemlock” is usually applied to the eastern relative, used so commonly for joists and timbers in building construction; hence the name “western hemlock” for the former. The western tree is far superior in its intrinsic qualities, but because the dense stands are far removed from the center of lumber distribution and because the trade has not been thoroughly educated to its many uses the wood is not utilized as advantageously as it should be. The name hemlock seems to prejudice many consumers against this species because of a recollection of the eastern hemlock and its tendency to splinter, warp and twist. The western hemlock, however, does not reveal these bad traits.

This tree is found in great abundance in the coast region of southern Alaska, British Columbia, Washington and Oregon. In British Columbia it extends up the valley of the Fraser and of other rivers to the south, to the limit of abundant rainfall. It is found on the Selkirk and Gold ranges, and as far eastward as Kicking Horse pass, on the western slope of the Continental divide. It reaches as far southward as Marin county, California, to a point just south of Cape Mendocino. In Washington this tree extends across the state and reaches eastward to the western border of the Rocky mountains in northern Montana, and to the Cœur d’Alene in Bitter Root mountains of Idaho. From the coast the tree ranges in Oregon to the western slope of the Cascade mountains, and as far southward in the Cascades as the northern base of Huckleberry mountain in the valley of Union creek, and about 12 miles southwest of Crater lake. It is noted locally at Lake of the Woods (T. 38 S., R. 6 E., W. M.). It is not found in the Siskiyous.

Western hemlock is a moisture-loving tree and grows best where there is an abundant water supply. When in the interior and removed from regular and abundant rainfall, its roots strike deeply into the soil in quest of moisture. Ordinarily, however, the root system is wide-spreading and superficial, a
Western Hemlock (Tsuga heterophylla)

The common associates of western hemlock in the forest are western red cedar in the bottoms and moist pockets, Sitka spruce in the tideland regions of the coast, and Douglas fir elsewhere with a mixture of grand fir, and numerous other trees of lesser quantities in the valleys. Western hemlock is very tolerant of shade. Like any species of trees, hemlock prefers sunlight, providing other exacting factors, such as moisture, are not disturbed, but this tree is gifted with the ability to endure shade, and when crowded can even continue to grow with but very little top light.

Western hemlock is one of the most beautiful of all the western conifers. To be sure it lacks the stateliness of Alpine firs, but, on the other hand, it has not their stiff, rigid appearance. The hemlock is graceful with its fine lacy foliage and drooping branches. It may always be identified by the tips of the branches, especially by the gracefully drooping leader. *

* Twenty miles west of Corvallis, Oregon, there stands a variation of the western hemlock, designated locally as a weeping hemlock (Tsuga heterophylla flaccida). It is singularly marked by irregular and inverted branches, giving the tree a decided "weeping" habit.
Western juniper is distributed from the Canadian line to Lower California and eastward to the Northern Rocky mountains. In Oregon the range is principally throughout the arid portions of the eastern part of the state. It ascends the east slope of the Cascades up to about 6,000 feet. The wood is very enduring in contact with the soil. Because of this, juniper is highly prized for post material. Tests have been made of this wood for pencil manufacture, and it has been found to be well suited to this use. Due to the scattered nature of the stand, no estimate has been made of the amount of this species in the state.
WESTERN RED CEDAR

Thuja plicata Don.


THIS magnificent tree easily surpasses all others of that group commonly designated as cedars. Because of the great size attained by the mature trees, the species is sometimes designated as giant arbor vitae, a name which contrasts it with the rather insignificant arbor-vite of the east. Throughout the region of its distribution, however, it is usually called western red cedar, or just plain cedar. The name "canoe cedar" has been used by some to indicate a use made of the tree by certain western tribes of Indians who took advantage of the unusual size of the trunks and of the ease with which the wood may be worked for the construction of their great war canoes.

The wood of western red cedar is light and soft. It is one of the lightest of the conifers, a cubic foot of the air-dried wood weighing about 24 pounds. It splits easily and is remarkable for its great durability. Because of its resistance to decay it is used extensively in the
Oregon's Commercial Forests

Western Red Cedar (*Thuja plicata*)

a. Fruiting branch showing scale-like overlapping leaves with resin pocket on outermost portion of each leaf, old persistent cone with reflexed scales and also newly matured cones. Each cone has its individual stem. Note the resemblance of cones to “Dutchman’s Pipes.”

(*x* indicates scale of reduction.)

Manufacture of shingles, cooperage stock, piling, posts, as well as telephone, telegraph, and transmission poles. The Japanese value red cedar very highly for house construction purposes because it endures weathering well and because of the constituents in the wood which render it resistant to the attacks of ants.

Western red cedar has a range from the coast region of southern Alaska southward through the coast ranges and islands of British Columbia, through western Washington and
Oregon down to Mendocino county, California. In British Columbia it goes east to the western slope of the Continental divide. It appears in the Coeur d’Alene, Bitter Root and Salmon River mountains of Idaho and extends east to the western slope of the Rockies, in northern Montana. In Oregon it grows on both sides of the Cascade range. On the west side of the Cascades it goes south to Crater lake. Scattered specimens are found occasionally east of the Cascades in the Mt. Hood region.

Due to its moisture-loving nature, western red cedar makes its best development within the fog belt of the western coast of British Columbia, Washington and Oregon. This territory really marks the commercial range of the species. In this region trees have been found with a diameter of 18 feet and a height of 200 feet. These, of course, are unusual. Ordinarily the diameter will range from 3 to 8 feet. The total estimated stand of red cedar in the United States is about 54 billion feet. The estimated stand of cedar in Oregon is 6 billion board feet. The 1925 cut of cedar in Oregon was 54 million feet. In the same year Washington cut 226 million feet. About 78 per cent of all shingles manufactured in the United States are made of red cedar.

Mature specimens of red cedar have a decided tendency to become “swell-butted.” The lower portion of the stem is apt to be roughly fluted and the entire bole has a pronounced conical form due to rapid taper. The growth is fairly rapid, seedlings averaging 18 inches in the third year. Because of the shreddy, inflammable nature of the bark, the trees are easily damaged by fire. The durable character of the wood, however, makes it possible to salvage these fire-killed trees many years later. Over-mature trees are subject to a dry rot, a condition designated as “pecky” by woodsmen. In common with western hemlock, western red cedar reproduces best on moist litter and duff. The seed is borne in large quantities even on small trees.

Red cedar is seldom found in pure stands. It mingles freely with other species, occurring singly or in groups, usually taking possession of situations which its more light-loving rivals cannot endure.
PORT ORFORD CEDAR

Chamaecyparis lawsoniana (Murr.) Parlatore

FIELD CHARACTERISTICS: Boles straight, crowns narrow with drooping branches. Height 100 to 175 feet, rarely 200 feet. Diameters 3 to 6, and occasionally up to 8 feet. Bark 6 to 8 inches thick at base of mature trees. Broken into loose, narrow ridges, brown with reddish tinge underneath. Leaves scale-like on flat sprays, soft to the touch. Cones small, berry-like, maturing in first season. One to four reddish brown seeds in each cone scale.

PORT ORFORD CEDAR is variously called ginger pine, white cedar, Oregon cedar, and Lawson cypress. The tree is limited in general range to a narrow strip of the Pacific coast approximately 225 miles long, and rarely more than 40 miles wide. The northernmost limit is in the vicinity of Coos bay. The Coos bay region, in fact, practically includes the entire commercial range of Port Orford cedar. The botanical range extends southward into California, where only a few trees are found here and there in scattered localities. The southern limit of the range is Mad river, Humboldt county, near Humboldt bay. It is not a true cedar.

The tree occurs in dense stands in Oregon only; in fact, its commercial range is restricted to that region north of the Rogue river along the coast. The best development is attained about three miles from the shore and between the mouth of the Coquille river and Point Gregory, where it is the chief species in an almost unbroken belt about 20 miles long and 12 miles wide. Here the tree averages 3 1/2 to 6 feet in diameter, and 125 to 180 feet in height, with the stem clear of limbs often for 150 feet. A maximum height of 200 feet and a maximum diameter of 12 feet near the ground have been recorded, but a tree of this size is extremely rare.

In quality, Port Orford cedar ranks among the most valuable woods in the United States. A rough estimate places the remaining stand at about 1,700,000,000 board feet, principally in Coos and Curry counties. The wood, because of its strength and lightness and because of the possibility of securing clear, straight-grained pieces, is suitable for airplane use. Japan takes a large proportion of the cut, either in the log or in squares, for use in house construction. It is excellent veneer stock, and is used in general interior finish, for tunnel work, for ties, boat construction, and pattern stock. It is remarkably durable wood, lumber having been cut from trees 40 years after they had been fire-killed. A common trade name for this tree is white cedar.
Because of its beautiful form and graceful foliage when grown in the open, the Port Orford cedar has been widely used for ornamental planting. It is a fairly rapid grower and may be generally used in Western Oregon. In addition to this, the tree is especially adapted to forest planting under favorable moisture conditions. Due to the high value of the wood, the tree should have favorable consideration for this purpose west of the Cascade mountains.

**SUGAR PINE**

*Pinus lambertiana* Doug.

**FIELD CHARACTERISTICS:**
Trunks of mature trees tall, straight, clear, cylindrical, slight taper. Tops of young trees symmetrical, branches regular. On mature trees tops flattened and branches irregular, usually two or more characteristically long branches. Bark brown to reddish, in young trees smooth and grayish in color. Bark on immature trees deeply fissured and divided into long, flat sections, from 1 to 3 inches thick. Cones few, pendulous, carried on tips of branches, slender, 12 to 24 inches in length. Seeds thin-shelled, about ¼ inch long, winged, edible. Needles 5 in a whorl, 2 to 4 inches long.

**SUGAR PINE** is a tree of marked individuality. It ranges from the Santiam river in Oregon down to Lower California and from the Pacific in southern Oregon to the east slopes of the Cascades and Sierras. Its commercial range, however, is limited to the region extending from Douglas county in Oregon to Kern county in California. The larger portions
of the commercial stands are found on the west slopes of the Cascades and Sierras.

The tree ranges occasionally as low as 2,000 feet and has been reported at an elevation of 11,000 feet. The merchantable stands, however, lie largely in situations between 3,000 and 9,000 feet. It never occurs in pure stands. Its common associates are western yellow pine, Douglas fir, incense cedar, white fir, red fir, and lodgepole pine. It is the largest of the pines, often attaining a diameter up to 7 feet and a height of 200 feet. It reproduces only from the seed. Squirrels prize the seed for food and frequently prevent reproduction by eating the entire supply.

In beauty of form the sugar pine is unsurpassed by any timber tree. The massive trunks of mature specimens are suggestive of huge columns. They extend upwards, clear of limbs, and symmetrical, for more than a hundred feet. To the lumberman there is little suggestion of waste about them. Their cones, gracefully hanging at the tops of wide-flung limbs, their rather sparse tops, the characteristic bark, deep-furrowed and broken into “turtle back” plates, present features which are not easily forgotten.

Sugar pine is rivaled in quality by only one American pine, the famous white pine of the east. In size it is unsurpassed by any pine. Commercially, it is the most valuable timber pine on the Pacific coast. It is estimated that Oregon has 2,400,000,000 feet of sugar pine.
TWO DISTINCT FORMS of this pine exist. The one restricted to the region of the Pacific coast is known as *Pinus contorta* and is commonly called beach pine, sand pine, scrub pine, and tamarac pine. This is scrubby and distorted in outline, and because of its diminutive size, is of little value. The other, the mountain or upland form, is larger and, in certain regions, has considerable commercial value. It extends inland to the slopes of the Continental divide and is identified as *Pinus contorta*, var. *murrayana*, and by some as *Pinus murrayana*. This form is commonly called lodgepole pine, but tamarac, spruce pine, and Murray pine are names frequently applied to it. In the mining region of the Rocky mountains it is extensively used for mine timbers. It is also employed for ties, posts and poles under conditions where short service only is required. However, when creosote treated, the timber will last 20 years or more in contact with the soil. The stand of lodgepole pine in Oregon is roughly estimated to be 6 billion board feet.

Including both forms, this tree has greater latitudinal range than any other pine. It is found from the Yukon river south to the mountains of Lower California. Its east and west distribution is from the Pacific coast as far as the Black Hills of South Dakota. Throughout this wide range the tree endures many diversities of climate and occurs from sea level to an elevation as great as 11,500 feet. In Oregon the tree seldom reaches an elevation of more than 6,000 feet.

North and east slopes are preferred by this tree, while south slopes appear to be least favorable to its development. It makes its best growth upon high plateaus and benches in the vicinity of streams and meadows. Limestone soils are avoided, the preference being for moist sandy sites with gentle slopes, although the tree is adapted to dry gravelly soils. Throughout the Rocky mountains, from the far north down to the southern part of Colorado, this tree forms extensive forests of pure stands. It occurs more in mixture with other species in the Cascades, Sierras and Coast mountains. In the Paulina mountains of Oregon lodgepole forms 50 per cent of the forest.
In the Deschutes National forest it forms 19 per cent of the forest, while in the Whitman it makes up one-third of the stand. The commercial stand of lodgepole in Oregon is not much over 5 billion board feet.

Lodgepole pine forests are particularly susceptible to fire damage because of the thin bark of the tree and the very dense stands. The small cones which remain closed long after the two-year period of ripening, are forced somewhat by the intense heat of these fires, and are subsequently easily opened.
by the heat of the sun, with the result that the fire-swept forest floor with its exposed mineral soil is well sprinkled with seed. It follows that a new forest quickly springs up and replaces the old. The trees produce seed as early as ten years, but the largest production is from 20 to 40 years. Where lodgepole pine grows in pure stands the forest is decidedly dense. In places the younger stands are so thick as to be almost impenetrable.

In the struggle for survival, these trees produce long, slender poles which are admirably adapted to the common use of corral poles, telegraph poles, telephone poles, house logs, railway ties, and fuel. The Indians commonly used the small stems as supports for their lodges, hence the name “Lodgepole.”

In Oregon this pine grows slowly. It makes an average diameter of 12 to 18 inches and a height of about 90 feet. In the high Sierras, trees are occasionally found 6 feet in diameter and 150 feet high.

**WESTERN WHITE PINE**

*Pinus monticola* Dougl.

**FIELD CHARACTERISTICS:** Tall, slender bole, narrow symmetrical crown, with short branches. Bark broken into small square blocks, on mature trees about 1 inch thick, in color varying from cinnamon in open stands to grayish purple in dense forest, smooth and thin on young trees. Leaves 2 to 4 inches long, 5 in bundle. Cones pendulous, at tips of branches 5 to 10 inches long, very slender, mature at end of second summer.

**IN QUALITY** western white pine ranks as one of the most valuable woods in the United States. It meets the same requirements in house construction as the white pine of the Lake states. Estimates place the stand of western white pine from 20 to 25 billion feet. Probably 80 per cent of this amount is in Idaho and western Montana. For a long time the lumber from this species went on the market as Idaho white pine. Oregon has about a billion and one-half feet of this timber.

The range of western white pine extends from southern British Columbia over the northern Rocky mountains through the Coast range and into southern California. In Oregon the tree is distributed sparingly through the higher elevations of the Coast and Cascade ranges. It also appears in the Blue and Warner mountains. In this state it seldom forms more than 3 per cent of the stand.

In regions best suited to its growth, it may attain a diameter of 5 feet and a height of 200 feet. Average mature trees run from 2 to 3 feet in diameter. Due to the thin bark, the tree
is easily damaged by fire. It belongs to the group of white pines which are subject to attack by white pine blister rust, a tree disease which the Federal Government is making earnest efforts to hold in check. The tree reproduces best on exposed mineral soil. The young tree will endure shade for a time, but ultimately it must have full light for proper development.
NOBLE FIR

*Abies nobilis* Lindley

**FIELD CHARACTERISTICS:** Leaves pale to deep bluish-green, usually with silvery tinge. Leaves on exposed branches curved to upper side, giving decidedly compact appearance; four angled, pointed, and about three-fourths inch long. On sheltered branches leaves flat and usually notched at end, and are 1 to 1½ inches long. Cones 4 to 6 inches long, and 2 to 3 inches in diameter, standing erect on branches, and usually massed near top of tree. Bark 1 to 2 inches thick, divided into flat, narrow ridges. Surface bark ashy-brown, freshly exposed bark, reddish-brown. Mature trees, height up to 250 feet, diameters up to 7 feet. In dense forest straight, clear bole for 100 feet and more.

NOBLE FIR is the most valuable commercial species of the so-called "Balsams," or true firs. It is called red fir, balsam fir, and noble fir. A common misnomer is the application of the name "larch" to this species. No doubt lumbermen have originated this name in the past to rid this valuable fir of the prejudice which has always existed against the name, "white fir." At any rate the name has persisted and continues to cause much confusion among woodsmen and students. "Larch mountain," in the forest environs of the city of Portland, is, no doubt, named in honor of the noble fir which grows in such splendor upon its slopes, rather than of the true larch, which is less frequently represented. Noble fir, however, is in no wise related to the larch family. The noble fir is persistently evergreen, while the larch is distinctly deciduous, shedding all of its leaves each winter.

Noble fir is restricted to the Pacific Northwest. It is found only in the Coast range and Cascades of Washington and Oregon, extending to the north as far as Mt. Baker. It has been found in the Western Olympic mountains of Washington, and is sparsely represented in the Coast mountains of Oregon, being noted at an elevation of 4,000 feet on Mary's peak, in Benton county, and southward nearly to the Siskiyous. It is found on the east side of the Cascades southward only as far as latitude north 45°. It has been reported on the west side of Mt. Hood at a point 3 miles below Government camp and upward; on the north side at 4,500 feet; on the Clackamas watershed; Crater lake on Wizard island, and from 4,600 feet on the rim of the lake to the top; Browder ridge in the Santiam forest; and on the north side of the Siskiyous in the Crater National forest. The tree's altitude limits are between 1,400 and 6,000 feet, attaining the latter elevations chiefly in its southernmost range.
The commercial range of the tree is restricted to southern Washington and northern Oregon, in the Cascade mountains. The estimated stand is from 3 to 4 billion feet. The wood is odorless and free from pitch and hence is valuable as box material. It has been used for interior finish, siding and sash and door stock.

**Noble Fir (Abies nobilis)**

- a. Fruiting branch showing erect mature cone with extended bracts.
- b. Detail featuring arrangement of leaves particularly uppermost twigs; also found on small specimens.
- c. Arrangement of leaves occasionally found on lower branches of crown and also observed in small juvenile specimens.
- d. Lower side of cone scale showing irregularly notched bract with long tapering point.
- e. Winged seed, natural size.

(x indicates scale of reduction)
LOWLAND WHITE FIR
Abies grandis Lindley

FIELD CHARACTERISTICS: Straight trunk. Mature trees on favorable sites, 150 to 250 feet tall. Diameter 3 to 4 feet. Smooth or slightly broken light brown bark, about 1½ inches thick, hard. Tops narrow and pointed to rounded, extending nearly to ground in open stands; in forest, covering about one-half of the stem. Needles of lower branches two-ranked and flat, 1 to 2½ inches long, upper branches dense and shorter. Cones 2 to 4 inches long, 1½ to 2 inches in diameter, oblong, erect, and carried largely in topmost branches.

LOWLAND WHITE FIR is distributed from southwest British Columbia to northern Sonoma county in California, and east to northern Idaho and Montana. It is decidedly a lowland tree, making its best growth in the moist valleys and lower slopes of the region of its distribution. In Oregon it appears in the Blue and Powder River mountains, but chiefly in the valleys and lower slopes of the Cascade and Coast Range mountains.

While the tree ranks in size with the valuable timber trees, the wood of grand fir is of little use for lumber. The wood is very knotty and decays quickly when exposed to moisture. It is used to a limited extent for pulp-wood. It appears in mixture with other timber trees of its region. Ordinarily the tree may be identified by the disagreeable odor of the wood, a characteristic which has led some woodsmen to dub the tree “stinking fir.” The tree is variously called white fir, grand fir, balsam fir, and lowland white fir. A rough estimate places the amount of this species in Oregon at 9 billion feet.
LOWLAND WHITE FIR (*Abies grandis*)

*a.* Twig from top of tree showing erect cone and persistent axis of cone of previous year.

*b.* Twig showing flat spray of leaves characteristic of lower branches. Note notched leaves and blunt, resin-coated winter buds.

*c.* Lower side of cone scale featuring bract distinctly notched, shoulders slightly rounded and with short tip.

*d.* Detached winged seed.

*σ* indicates scale of reduction.
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SITKA SPRUCE

*Picea sitchensis* (Bong.) Trautvetter and Mayer

**FIELD CHARACTERISTICS:** In dense stands, long bole, moderate taper, open conical crown. Branches pendulous, small branches lacy. Leaves about 1 inch long, 4-angular, usually prickly pointed. Bark thin, small loose scales, dark reddish-brown. Cones abundant, pendulous, from 1 to 4 inches long, cylindrical, about 1½ inches in diameter.

**S**ITKA SPRUCE derived its common name from the Alaskan town which marks the vicinity of its northernmost range. The name "Tideland spruce," however, is perhaps more appropriate, in that it suggests the limited inland distribution of the tree, especially along the coast of Oregon and Washington, where it penetrates the interior only along estuaries and bays. In Alaska this spruce continues from the tideland flats and ascends the slopes of the mountains to an elevation of 3,500 feet. The tree is very exacting as to moisture

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**Sitka Spruce (Picea sitchensis)**

a. Fruiting branch showing pendent cones and leaves standing out from all portions of the stem.

b. Winged seed.

c. Detail featuring persistent woody leaf base.

(a indicates scale of reduction.)
SHOWING CHARACTERISTIC BUTT SWELL OF SITKA SPRUCE
This species is tolerant of shade; in fact, reproduction will take place, and small trees will continue to grow when shaded from the side, but a certain amount of top light is required for full development. When fully grown the bole is heavily butressed at the base, shows excessive taper and in fairly dense stands carries a pyramidal crown down two-thirds of the length of the tree. In open stands it holds its limbs to the ground.

Lent reputation as a specialty wood. The war made the reputation of spruce for airplane stock, and it is also used for boxes, ladders, veneer, and woodenware. It is one of the leading pulpwoods on the West Coast. The estimated stand of Sitka spruce in Oregon is 2 billion feet. The 1925 cut was 175 million feet. The great reservoir of Sitka spruce is in Alaska. This territory has not yet been fully cruised.

Moist, sandy soils in stream bottoms and along the coast are preferred. The tree will grow, although stunted, on thin soils such as found in the north, but here an abundance of moisture is supplied. Sitka spruce grows somewhat in pure stands in the north, but is more frequently found mixed to the south. Its common associates are western hemlock and, to a lesser extent, redwood, red cedar, maple, black cottonwood, and yellow cedar. This tree is relatively free from insect and fungous attacks. Although found in humid climates the trees are subject to great damage by fire if the forests do become dry, because of the thin bark and dense stands.

This species is tolerant of shade; in fact, reproduction will take place, and small trees will continue to grow when shaded from the side, but a certain amount of top light is required for full development. When fully grown the bole is heavily buttressed at the base, shows excessive taper and in fairly dense stands carries a pyramidal crown down two-thirds of the length of the tree. In open stands it holds its limbs to the ground.

Sitka spruce is remarkable for its rapid growth and great size. The average forest grown tree is 3 to 4 feet in diameter and 100 feet in height. It makes a maximum diameter of 15 feet and a height of 250 feet. The tree reaches maturity in about 250 years, but individuals twice that age are not uncommon. It is easily the largest of the spruces. In volume growth, on the better sites, it will produce 1,000 board feet per acre per year for the first 100 years of growth.

The wood of Sitka spruce is light, soft, tough, straight-grained, and easy to work. While the larger part of the spruce cut is manufactured into lumber, yet the species has an excellent reputation as a specialty wood. The war made the reputation of spruce for airplane stock, and it is also used for boxes, ladders, veneer, and woodenware. It is one of the leading pulpwoods on the West Coast. The estimated stand of Sitka spruce in Oregon is 2 billion feet. The 1925 cut was 175 million feet. The great reservoir of Sitka spruce is in Alaska. This territory has not yet been fully cruised.
WESTERN LARCH

*Larix occidentalis* Nuttall

**FIELD CHARACTERISTICS:** Trunk straight and clear, 50 to 100 feet. Crown short, narrow, open, running to a point. Bark on mature trees reddish-brown, 3 to 6 inches thick near base, deeply furrowed, thinner and smooth above. Foliage pale green, changing to bright yellow in the fall. Leaves in clusters from 14 to 30, 1 to 1 1/2 inches long, deciduous. Cones 1 to 1 1/2 inches long, cone scales covered with soft, whitish hairs. Heart wood reddish-brown, sapwood whitish.

**THIS TREE,** which is sometimes called tamarack, Montana larch, Oregon larch, as well as western larch, ranges from southern British Columbia through the Cascade mountains into northern and eastern Oregon and into northern Idaho and western Montana. Its commercial range in Oregon is in the northeastern part of the state. As a rule it is found in mixture with other species. It makes the best growth on deep, porous soils, but will endure rather difficult situations. It is the only cone-bearing tree in the state which sheds all its leaves in winter. This peculiarity makes identification absolutely certain.

Occasional specimens of western larch reach a height of 200 feet, but the average height is from 160 to 180 feet, with diameters from 2 to 4 feet. Mature trees are usually clear of limbs from 50 to 100 feet, with straight boles and with little taper. It is a light-demanding tree, and hence, in its early years, is at a disadvantage with its shade-enduring associates.
The estimated stand of larch in Oregon approximates four and one-half billion feet. Since it occurs in mixture with other species, the annual cut is difficult to determine. The wood is reddish-brown and heavy. It is durable and ranks after Douglas fir and hemlock in strength. It is used mainly for structural purposes. It stands weathering well and is particularly adapted to outside use.

**BIGLEAF MAPLE**

*Acer macrophyllum* Pursh.

**FIELD CHARACTERISTICS:** Open grown trees, short bole, broad, dense, rounded top, profusely branched. Forest grown trees 20 to 90 feet in height, short, narrow, irregular crown. Boles rarely 3½ feet in diameter, usually 1 to 2 feet. Bark ash-gray to brownish-gray in color, on old trees broken into rough, fairly broad ridges. Leaves 6 to 12 inches, rarely 15 inches wide, divided into 5 broad lobes. Prolific seed producer, fruit maturing in late fall; seed covered with short, stiff hairs. Seed wings 1 to 2 inches long.

**BIGLEAF MAPLE** is commonly known as Oregon maple in this state. Its general range is from southern Alaska to southern California and principally west of the Cascade and Sierra Nevada mountains. In Oregon it is quite generally distributed west of the Cascades, making its best growth in the rich soil of the lower valleys. It is found most frequently in mixture with Oregon ash, red alder, lowland fir, and Douglas fir. Occasionally pure stands of maple are found in the moist soils of the valley bottom lands.
The forest grown trees produce a fairly good grade of lumber. The wood is hard, dense, and strong, and is used locally for practically all the purposes for which the eastern maple is employed. It excels all the other local hardwoods for use in the manufacture of furniture. The "bird's-eye" form is occasionally found and is especially valued in the production of novelties. The tree is comparatively long-lived, occasionally reaching 150 to 200 years. Trees grown in the open appear to be especially liable to attacks by fungi. For this reason Oregon maple is poorly suited to street planting.

**Broad Leaf Maple**

(Acer macrophyllum)

a. Fruiting branch. Note the hair-like appendages covering the seed coat cluster, also note the characteristic large leaf.

b. Diagrammatic sketch of terminal winter bud, enlarged.
OREGON ASH

*Fraxinus oregona* Nuttall

**FIELD CHARACTERISTICS:** Forest trees 50 to 80 feet high, 15 to 30 inches in diameter. Bark deeply checked, soft on surface, ashy-brown. Branches distinctly opposite. Large chocolate-brown terminal buds. Leaves 6 to 12 inches long, with 5 to 7 leaflets. Seed ripens in early fall, growing in large clusters.

The OREGON ASH is so named because it occurs most generally in this state. It ranges northward to the shores of Puget sound, but never east of the Cascade mountains, nor in the Olympic mountains. To the south the range extends into California as far as San Francisco bay in the coast region, and to the mountains of San Bernardino and San Diego counties along the Sierra Nevada mountains. In Oregon it is limited to the western portion of the state.

In some of the mountainous regions of its range this tree is found as high as 2,500 to 3,000 feet in elevation, but ordinarily it occurs in valleys and along river bottoms. Some of the best stands are in the Willamette River valley, although the largest growth is attained in the rich, deep, humus soils in southwestern Oregon.

The common associates of Oregon ash are red alder, broad-leaf maple, and California laurel. The tree is also found with grand fir and Pacific post oak in the north, and with white alder and California sycamore in the south. It is occasionally found in pure stands, but in such cases is limited to very small patches. This tree can endure only partial shade as small seedlings, and in later life cannot thrive without top light.

The wood of the forest-grown trees is moderately fine grained, and has a tendency to be brittle, but the wood of thrifty young open-grown trees is coarser grained and elastic, particularly the sapwood. Except for a dull, yellowish-brown color and more open texture in the spring wood, the wood is quite similar to the eastern ashes and can be used for much the same commercial purposes.
OREGON ASH (*Fraxinus oregona*)

a. Fruiting branch showing besides fruit the typical compound leaf.
b. Detail illustrating small lateral buds and the much larger terminal bud.
c. Twig detail illustrating opposite branching and abortive twig.

(*x* indicates scale of reduction.)
The timber of this oak is very durable in contact with the soil. When properly seasoned, so that an otherwise high moisture content cannot encourage the growth of wood-destroying fungi, posts made from this wood will last through long periods of time. There is on record a case in southern Oregon where oak fence posts have been in the ground 56 years, and, judging from the general appearances, they can endure for another half century.

The oak reproduces itself by sprouts and by seedlings. The best stands are invariably of seedling origin. Acorns are produced each year and in this respect the tree is easily distin-
guished from the black or red oaks which mature their fruits in two years. The tree is sometimes called Pacific Post oak, Oregon oak, Prairie oak, and Western White oak.

PACIFIC POST OAK (Quercus garryana)

a. Fruiting branch; note saucer-shaped base to acorn, the pointed buds and the entire margins on lobes of leaves.
b. Twig detail illustrating pointed winter buds.

(x indicates scale of reduction.)
FIELD CHARACTERISTICS: Forest grown trees, comparatively straight trunk with rather slender side branches. Open grown trees profusely branched. Top rounded. Height 50 to 100 feet, but normally 40 to 50 feet. Diameter 10 to 20 inches. Bark smooth, thin, gray to whitish in color. Buds deep red. Leaves 3 to 6 inches long, larger on young thrifty shoots, edges notched. Produces seed abundantly. Seed carried in little cones, one-half to 1 inch long. Seeds bordered by wing-like growth.

RED ALDER ranges from southern Alaska along the coast to south central California. It makes its best growth in moist bottoms along streams. Its moisture-loving tendency is shown by the dense growth which it makes along the streams of western Washington and Oregon. It comes in quickly and in dense stands following logging and fires which remove the conifer forests. It makes volume growth with exceptional rapidity. It is in the main a transition forest, serving as a temporary ground cover until the taller and hardier conifers dominate the situation by topping the alders and thus shading them out.

Red alder, though a secondary forest tree, is coming to command the attention of woodworkers because the timber...
has a cherry-like, fine grain, and while light in weight, is comparatively strong. Recently alder wood has come on the market in considerable quantities for furniture manufacture. With the lessening of the hardwood supply in the east this particular species should have a larger market in the future. A rough estimate places the amount of merchantable alder in Oregon at 750 million feet. Due to the fact that alder in various stages of growth occupies thousands of acres of cut-over and burned-over lands, and that this species takes on volume with great rapidity, such estimate must be unreliable. It is safe to state that it is the leading broadleaf tree of the Pacific slope, and that it will play an important part in forestry operations of the future.

INCENSE CEDAR (Libocedrus decurrens)
Fruiting branch and winged seed, later enlarged. Small cone shows two seed leaves.
MINOR SPECIES

THE FOLLOWING TREES are of commercial size, but, due to limited amounts or to the character of the wood, are of little commercial value:

ALASKA CEDAR (*Chamaecyparis nootkatensis*) ranges south from southern Alaska in the coast region to the Siskiyou Mountains. It is sometimes called yellow cedar and yellow cypress. The narrowly conical crown, as a whole, has a weeping appearance. The little cones are deep russet brown with a very conspicuous bloom. The tree might be mistaken for western red cedar by the casual observer. However, the sulphur-yellow wood clearly distinguishes it from that species. In Oregon, the tree usually occurs between 2500 and 7000 feet elevation.

INCENSE CEDAR (*Libocedrus decurrens*). This tree is distributed from the Santiam River in Oregon south on the west slopes of the Cascade mountains through California to Lower California. The mature trees have rapidly tapering trunks and widely buttressed bases. The bark is cinnamon-brown and ridged. Young trees have thin, smooth, reddish-cinnamon bark. The tree makes an average height of 75 to 90 feet. There are two seed leaves to the little cones. The wood is a dull, yellowish brown, sometimes tinged with red. It is fine-grained and splits easily. On account of its durability, it is used for posts and poles. It is being used to a limited extent for pencil stock. Since it occurs in mixture with other species, the greater part goes into lumber in the general operation. Probably Oregon has less than a billion feet of Incense cedar, while California has ten times that amount.

REDWOOD (*Sequoia sempervirens*) ranges from the southwestern border of Oregon, in Curry county, south in the coast region to Monterey County, California. The tree reaches a maximum diameter of 15 feet and a height of 300 feet. Exceptional trees exceed these figures. An area of a few thousand acres of forest land includes all the redwoods in Oregon.

MOUNTAIN HEMLOCK (*Tsuga mertensiana*). This species ranges from southern Alaska south through the mountains to Central California. Since this is an Alpine species, it seldom is used commercially. It has gracefully drooping foliage, dark to pale blue-green. The cones are

FRUITING BRANCH OF MOUNTAIN HEMLOCK (*Tsuga mertensiana*)

Showing larger cones and denser leaf clusters than those which characterize *Tsuga heterophylla*. 
much larger than those of western hemlock, averaging about two inches in length. In Oregon, the tree is found at elevations between 5000 and 7000 feet on both slopes of the Cascades and in Powder River mountains.

WHITE FIR (Abies concolor). The range of this species is from the Siskiyou mountains of Oregon south to northern Mexico. As a commercial tree, it is of small importance in Oregon, due to limited distribution. In California, it has had a limited use as a box wood.

SILVER FIR (Abies amabilis). This species extends from southern Alaska south to Crater lake in the Cascades, and in the Coos range, about 25 miles south of the Columbia river. The larger part of the possibly commercial stand of silver fir is in Washington and northern Oregon. It occurs in mixture at elevations from 1000 to 5000 feet. The wood is used to a limited extent for pulp. The young trees have a thin, smooth, ash-gray bark, marked with chalky-white areas. Occasional trees reach a height of 200 feet and a diameter of 6 feet. There is a possible stand of 10 billion feet of this species in northern Oregon.

CALIFORNIA RED FIR (Abies magnifica). In Oregon this tree is found at elevations of 5000 to 9000 feet in the southern Cascades to a region a few miles north of Crater lake. The deep, red-brown bark, irregularly divided by diagonal furrows, which give a peculiar zig-zag trend to the ridges, is decidedly characteristic of the species. While of timber size, the limited amount in Oregon makes it of little commercial importance.

KNOB-CONE PINE (Pinus attenuata). This tree ranges through the Coast mountains of southern Oregon and in the Cascades, south from the McKenzie river. It is a three-leaf pine with cones which adhere to the branches indefinitely, rarely opening until the tree is killed. The tree seldom exceeds 80 feet in height and 20 inches in diameter. It is chiefly valuable as a ground cover following forest fires.

ENGELMANN SPRUCE (Picea Engelmannii). Engelmann spruce is generally distributed from the Yukon south through the Rocky mountains to New Mexico and Arizona. In Oregon, it extends through the Cascades to the California line, generally from 3000 to 6000 feet. It also occurs in the Blue and Powder River mountains. It is a splendid forest tree and of high value where commercial stands exist. It is to be regretted that Oregon does not have much more than half a billion feet of this particular species. The tree is quite similar in appearance to Sitka spruce. Contrasted with Sitka spruce, the needles are soft-pointed and the cones are smaller, usually about one and one-half inches in length.

PACIFIC YEW (Taxus brevifolia). This tree ranges from Alaska to central California and east to western Montana. While but little known in the past, except to woodsmen, Pacific yew has recently acquired a prominence and value due to the development of archery. The yew wood is peculiarly adapted to the making of bows. It is a small tree, ordinarily 20 to 30 feet high and 6 to 12 inches in diameter. The much sought yew stock is found in the larger trees which occasionally get up to 50 feet in height and a diameter of 30 inches. The bark is very thin, and is composed of papery, purple, easily detached scales. Beneath the scales the newer bark is clear rose-red or purple-red. The fruit is bright red, small, and often eaten by birds. To the casual observer, the yew would be mistaken for a conifer. Aside from not being a cone bearer, the yew differs from conifers in that male and female flowers are produced on different trees.

BLACK COTTONWOOD (Populus trichocarpa). This species ranges from Alaska to the San Jacinto mountains of California. In Oregon, it is found chiefly in the Coast and Cascade mountains and valleys. It is also found in the water courses of eastern Oregon. It is variously called
black cottonwood, balm cottonwood, and cottonwood. The trees make an average growth of 80 to 125 feet in height and 3 to 4 feet in diameter. Occasional specimens reach a diameter of six feet. The buds are reddish-yellow, up to three-fourths inch long, and are covered with a fragrant yellowish-brown gum, the source of the name “balsam cottonwood.” The wood is particularly suited to pulp making, and is also used to some extent for cooperage stock.

TAN OAK (Lithocarpus densiflorus, formerly Quercus densiflora). The tree ranges south from the Umpqua river in Oregon to south central California. The species is valuable for the high tannin content of the bark. It occurs in mixture with other trees. The trunk is usually left to decay when the bark has been removed. The wood has high value as furniture stock, and efforts are being made to salvage the material when general logging operations are in progress. In close stands, a straight clear trunk is formed. In the open, the crown is broad. Mature trees are from two to three feet in diameter and fifty to eighty feet high. The bark is cut by narrow seams into wide, squarish plates. The leaves have a general resemblance to those of the chestnut.

OREGON MYRTLE (Umbellularia californica). The range of this tree is from Coos county, in Oregon, south through the coast ranges and the Sierras to southern California. It is an evergreen tree which can be identified by the strong, camphor-like odor of its crushed leaves and bark. In the open it has a dense, rounded crown, quite ornamental in appearance. In the forest it forms a straight bole and makes a height growth up to 80 feet and a diameter to 3 feet. The wood has a beautiful grain, takes a high polish and recently has been considerably exploited for furniture and novelties.
CASCARA (*Rhamnus purshiana*). Cascara is distributed from Puget Sound south to central California and east to the Bitter Root mountains of Idaho. It appears in northeastern Oregon. Within the better portions of its range, this tree has a decided value on account of its bark, which is prized for its medicinal properties. The best growth is made in the moist soils of the Coast region. The tree supplies a secondary source of income to many ranchers within its range. Since years of exploitation have seriously reduced the supply of Cascara trees, efforts are being made to replace the stock by planting. It is likely that the tree will play a part in the forestry program of the future. It grows rapidly, and if properly handled, will reproduce satisfactorily from the stump.

MADRONA (*Arbutus menziesii*). In Oregon this tree grows chiefly along the foothills and streams of the southwestern part of the State. The tree is easily identified by the smooth reddish-brown bark, which peels off in thin flakes, and by the thick, leathery leaves. The wood is being used to a limited extent for furniture and novelties.

**Ewing Young Oak**

Historical Oregon tree planted in 1848 on the grave of Ewing Young, an Oregon pioneer; shows characteristic symmetrical rounded crown of open-grown Pacific Post oak.
THE FARMER'S WOODLOT

MUCH of that portion of Oregon which lies within the limits of the original forested area is but little advanced beyond the pioneer stage. The majority of the ranchers of this region view the forest cover largely as did the pioneers of the east and of the Lake states and the Mississippi valley. In the main the trees, to them, are an encumbrance, an obstacle in the way of their farming operations. This attitude is especially emphasized by the fact that the clearing of the land for agriculture means to them a capital investment all the way from $50 to $150 per acre. The ranchers of the timbered region of Oregon, however, will do well to take a leaf from the book of experience of their brethren of the east to the end that they may profit thereby. Eastern farmers held the forest as lightly as do the farmers of the west, and as a consequence are now feeling the pinch of high fuel and lumber prices. Men now hardly past middle age believed, when young, that they would never live to see the vast forests of the Lake states and of the South removed. But the forests of the Lake states are practically gone, and the forests are rapidly vanishing in the South. The farmer of the Lake states and of the upper Mississippi valley is now paying a freight charge of $15, or more, on each thousand feet of lumber he uses, in addition to a high price justified by the scarcity of the material. For fuel, the farmers of the Lake states have come to depend largely upon coal, and, consequently, suffer from cold in times of coal miner strikes and railroad tie-ups. Without intelligent action the history of the east will be repeated in the west.

Land clearing in the timbered area of Oregon has not progressed so far that the great majority of ranchers may not retain small areas of timbered land on their holdings, or may not acquire such areas in the shape of lands carrying second-growth material, at present regarded as of low commercial value. Such a woodlot would insure perpetual independence in the matter of a fuel supply and would, depending on the size of the tracts, furnish much of the fencing material and farm timbers constantly in demand on every ranch.

Douglas Fir a Woodlot Tree

Due to its rapid growth rate, the comparative ease with which it can be reproduced, its high fuel value, and the general utility of its wood for construction purposes, Douglas fir may safely be regarded as the most satisfactory woodlot tree for the greater part of the region west of the Cascades. The following table, taken from data collected by the Federal For-
DEVASTATION RESULTING FROM A CROWN FIRE
est Service, indicates the growth rate, by decades, of Douglas fir on average good soil in the foothill region west of the Cascade mountains. In securing the information contained in this table, measurements were taken on 361 sample plots having a total area of approximately 250 acres:

<table>
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<tr>
<th>Age (Years)</th>
<th>No. trees per acre</th>
<th>Diameter of average tree (Inches)</th>
<th>Height of average tree (Feet)</th>
<th>Yield per acre (Cu. Ft.)</th>
<th>Average Annual growth (Ft. B. M.)</th>
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From the above table it will be seen that the most profitable results, measured in terms of cubic feet per year, may be obtained by bringing the trees to an age of 50 years to 60 years. At 50 years the figures show an annual growth per acre of 215 cubic feet. The stacked cord of split fir, 4 feet high, 4 feet wide, and 8 feet long, contains approximately 90 cubic feet of solid material. It is evident, therefore, that there will be an average annual production of about two and two-thirds cords of wood per acre, if the trees are held until 50 years of age. A 20-acre tract properly managed, would thus supply about forty-eight cords of wood per year, twice the amount of fuel wood required to supply the needs of the average rancher. The surplus would furnish fence post supplies and the occasional requirement for dimension stuff and lumber.

There are hundreds of ranches in western Oregon which have small tracts of second-growth fir of varying ages. These tracts may easily be converted into permanent woodlots by the exercise of a little systematic care. Fire should be rigidly excluded from the woodlot areas and stock should not be permitted in them in sufficient numbers to pack the soil or to wear out the protecting ground cover of twigs and leaves. Undergrowth should be maintained on the edges of the tract to reduce, as far as possible, the effects of drying winds.
reach an age of 50 years, due to nature’s method of killing off the weaklings in order that the fittest may survive, a large amount of fuel wood may be obtained by thinning the stand whenever it appears to be too dense. These thinnings should remove the weaker trees, thus giving the stronger ones a chance to make diameter growth more rapidly. As is well known, the greater fuel value comes from the more mature woods. Since but a small number of the trees which start on an acre of ground reach an age of 50 years, due to nature’s method of killing off the weaklings in order that the fittest may survive, a large amount of fuel wood may be obtained by thinning the stand whenever it appears to be too dense. These thinnings should remove the weaker trees, thus giving the stronger ones a chance to make diameter growth more rapidly.

Douglas fir is one of the best of our timber trees to reproduce itself. The seed is most likely to grow if brought into direct contact with the mineral soil and the little trees thrive best in full sunlight. Clear cutting has been found advisable in case a second crop is desired. The slash should be burned

Organizing the Woodlot

With Douglas fir the ideal arrangement would be to have a tract of about 20 acres and to cut about two-fifths of an acre of the oldest stuff each year. This arrangement would make an annual yield of about 24 cords. It is very evident, of course, that it would take 50 years to bring about this ideal arrangement if one were to start with the bare soil and were to plant the entire tract at once. It is noted above, however, that there are many tracts of second-growth stuff scattered through the agricultural area of western Oregon. The woodlot tract could be selected in this second-growth and cuttings could begin with the stands which have attained the greatest age. As is well known, the greater fuel value comes from the more mature woods. Since but a small number of the trees which start on an acre of ground reach an age of 50 years, due to nature’s method of killing off the weaklings in order that the fittest may survive, a large amount of fuel wood may be obtained by thinning the stand whenever it appears to be too dense. These thinnings should remove the weaker trees, thus giving the stronger ones a chance to make diameter growth more rapidly.

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HOMER DAVENPORT COTTONWOOD
Historical tree planted near Silverton by the mother of the cartoonist
stored up in the soil by squirrels, mice, and chipmunks may not be destroyed by the heat. This stored-up seed germinates very quickly when the full light and warmth of the sun reach it. To supplement this supply, seed will be blown in from the surrounding trees since each little seed is equipped with a wing which enables it to go a long distance when backed by an ordinary breeze. In managing small woodlots of Douglas fir good reproduction can be assured by cutting narrow strips, thus giving the seed from the standing trees a chance to cover the cut-over area. The dense second-growth stands of the Willamette valley, which have followed fire and logging, furnish ample evidence to the observer of the wonderful power of this tree to establish the foundation of a new forest.

On many ranches there are small tracts along streams where the banks are too steep for cultivation, or where it is inadvisable to remove the tree growth because of the washing away of the soil which is sure to follow clearing. In such situations the broad-leaf trees, like maple, alder, ash, or cottonwood, which are native to the locality, may be encouraged to grow. These species do not grow as tall as Douglas fir and other conifers, and consequently will not throw as much shade outside their own particular site, a fact which should be taken into account where adjacent land is cultivated.

Yellow Pine for Woodlot Use

Yellow pine is well adapted to woodlot planting in many situations west of the Cascades. It will make an excellent growth in the drier situations and in gravelly soils where other species will not thrive. It makes an excellent fuel, but is inferior to Douglas fir when used for posts or in other ways in which durability is required.

Planting for Woodlot Purposes

There are many waste areas on ranches both in eastern and in western Oregon which can be profitably devoted to growing crops of trees for farm use. On most of the irrigation projects there are tracts which are not suited to tillage but which can be made to grow trees. Shelter belts can advantageously be established in many places for the protection of farm buildings and growing crops. There is no mystery about planting forest trees. The same care which will start a fruit tree will start a forest tree. Once started, the forest tree will thrive on little or no care. The State Forester is prepared to advise ranchers in the matter of forest tree planting both as to the species to plant and the cultural methods to employ.
Oregon State Board of Forestry

FORESTRY AND THE PUBLIC

Forest Land Ownership

When the rapid depletion of the eastern forests forced the problem of forestry upon the attention of Congress, that body passed a law, in 1891, empowering the President of the United States to set aside, for watershed and forestry purposes, such unappropriated forest lands as in his judgment appeared to be needed in the interest of public welfare. Acting under this law, the various Presidents have set aside a net area of approximately 158,800,000 acres of forest land. This area is permanently dedicated to the production of timber crops in the interest of all the people. It is a part of the policy of the Federal Forest Service, in handling this timber, to offer it for sale when it is mature. Out of the total area of public timber land set aside for forestry purposes, Oregon has within the borders of the state, under the control of the Forest Service, approximately 13,000,000 acres. All of this great wealth of standing timber will be manufactured into lumber within the state.

Of all the land which, under the various land laws enacted by the Congress of the United States, passed into private ownership, an area of over 368,000,000 acres is still in forest. Some of this land, when cleared, will be devoted to agriculture. Most of it is suited only to forest growth. As far as the state of Oregon is concerned, it has over 395,000 million feet of timber which is ready for the saw when market conditions demand it, more than 2,000,000 acres of land which has been cut over or burned over, but which is restocking comparatively well, and easily 2,600,000 acres of land which is now entirely unproductive, and which can grow timber crops to greater advantage than anything else. This property, the Forest Service land, the privately-owned timber land, and the non-producing forest land, the stumpage it carries and the stumpage it can produce, represent the material with which Oregon is directly and indirectly concerned. It presents a problem involving the use of the material now on the land, and a problem of land use after the timber crop is removed.

The Problem Both National and State

In discussing a forestry policy for Oregon or for any other state, it should be understood that the problem is intimately connected with that of the whole nation. The products from Oregon’s forests are marketed in Chicago, New York, and in Boston. The material goes there because it is needed there, just as Pennsylvania steel comes to Oregon because it is
needed here. Ordinarily the need for any commodity is expressed in the price people are willing to pay for it. Forest economists are convinced that there will be a need for all the timber which can be produced in all the potential forest lands in the United States, and that this need will be great enough to cause people to pay a price for the timber high enough to justify the growing of the crop. Oregon's forest problem is therefore dove-tailed in with the national forest problem and must be thought of in connection with it. Just as the state's obligation must extend to every county within its limits, so must government interest embrace every state in the Union. Oregon's first interest is in seeing that its own citizens are assured a plentiful supply of building material at reasonable prices for all time; that industries dependent upon timber can be established in the state with assurance of permanence; and
that absolute forest land is kept in crop so that it may contribute to the building of roads, the maintenance of state institutions, and to the support of all other proper state and local activities. Secondly, as one in a union of states, being itself located in a region favored by nature for timber growth, Oregon has an obligation to help grow the nation’s timber supply.

The Federal Government, on the other hand, is interested first in seeing that Oregon grows timber on every acre best suited to such use, in order that there may be produced in excess of the needs of residents of the state supplies for distribution to those states having little or no timber. Therefore, it behooves the government to encourage and assist all states in forest replacement. Obviously, this encouragement and assistance should go in the greatest degree to those states which can contribute most to the nation’s lumber yard. Oregon, having 20 per cent of the standing timber in the United States, should receive Federal aid approximately in that proportion.

Federal Forest Activities

National legislation ordinarily results when sufficient pressure is brought to bear on Congress to convince that body of the desirability for action. Congress has created the Federal Forest Service and charged it with the responsibility of administering more than 158,000,000 acres of forest land. The Forest Service is dependent directly upon Congress for funds to carry on its work. Every proper agency in Oregon should keep before Oregon’s congressional delegation the desirability of properly financing the Forest Service. The state has a very direct interest in the 13,000,000 acres of National Forest land within its limits. Every stick of timber on this land will be manufactured within the state and all the wealth resulting from converting standing timber into manufactured lumber will be circulated through the arteries of trade within the state.

If stumpage is worth $4 per thousand feet, a price well above the average in Oregon at the present time, and if manufactured lumber sells at an average price of $24 per thousand, it must be obvious that at least $20 per thousand has been expended for labor, for equipment, for food supplies, for transportation and for all the other items incident to lumber manufacture. Besides, Oregon labor and material will have been used in bringing the stumpage up to the point where it is ready for the purchaser. This will indicate roughly the interest which the state has in the mature and growing timber within the limits of the National Forests.
The National Forests and the State

Since a large area of forest land in Oregon is under Federal control and since these forests and forest lands are destined to play a very important part in the future economic life of the state, citizens of Oregon should have definite information concerning the fundamentals of National Forest administration and the economic relationship of these forests to the state.

The National Forests are administered wholly at Government expense and must by law annually return 25 per cent of the gross returns from such forests to the state. An additional 10 per cent goes for roads or trails in or adjacent to such forests. It is true that a large area in Oregon is not on the tax roll as a result of the Government's national forest policy, and also that present returns from National Forests fall far short of what the lands would return in the form of taxes if they were privately owned. It is reasonable to assume, however, that, with the demand for lumber turning in a greater and greater degree to the Pacific Northwest, the state will soon secure substantial revenue from National Forests and that under proper management such returns will be sustained from year to year. When that time comes, the forests under Federal control will be contributing more of their gross income to the state than any private business could possibly pay in the form of taxes.

The Federal Government is in effect practicing forest management on lands within the state, under a plan whereby Oregon participates in the returns from such lands. Had the Government desired to come into Oregon and purchase cut-over land on the same basis of future returns to the state as is now in effect on National Forest areas, it is reasonable to suppose that the plan would have been approved by the people of Oregon.
the state. This would have been recognized as a means of keeping in continued production mountain lands and other absolute forest lands considered of little value once the timber is removed. No private enterprise could hope to manage such cut-over lands profitably enough to justify paying to the state 35 per cent of the gross income in the form of a tax.

It is true that vast sums would have been paid the state as taxes on Federal Forest lands had they gone into private ownership and that, from time to time, there has been some annoyance due to Federal regulations and requirements. An understanding by the people of the state of the administrative methods of the Forest Service and a comprehension by the service of the needs of the state, have largely eliminated opposition to the National Forests and National Forest policies. This is especially true of the great stock-growing industry of eastern Oregon. The stockmen use the forest lands extensively for grazing purposes. Their organizations are on record as indorsing the Federal Forest Service and its policies. The near future gives promise of added financial help to the state from the National Forest areas. It is conceded that the National Forests have come to stay. The part of wisdom is to accept them and to try to make them profitable alike to the Government and to the state.

At the present time, the gross income from the National Forests of Oregon does not meet the cost of administration. It is of interest to know that, for the 22 years, 1905 to 1927, the total cost of administering the National Forests of the state aggregated over $12,051,000, and that for the same period the gross income approximated $7,984,000. In spite of the net loss of about $4,067,000, the Federal Government paid to the counties $1,996,000, a sum which is 25 per cent of the gross income. During the same time there was expended for roads and trails over $8,630,000, which makes an excess of expenditures of over $14,696,000 above income for the 22-year period. For the fiscal year ending June 30, 1927, the total expenditures made by the government on account of the National Forests of Oregon was $2,170,000. The total income was $757,000. While the expenditures were almost three times as great as receipts, yet the Forest Service paid to the counties of the state 25 per cent of the gross income, or over $189,000, and expended 10 per cent of the gross income for the construction of roads and trails in or near the forests. These figures will indicate the measure of responsibility which the Federal Government is assuming to the end that a part of the forest lands of Oregon may be kept permanently productive, and in contributing to the operating expenses of the counties in which the forest lands are located.
Federal and State Cooperation

The Federal Government, the state and the private timber owner each has a definite responsibility in the perpetuation of state and privately-owned forests. Federal and state responsibility are similar in character, for both must look to the perpetuation of forests for future generations, to the preservation of stream flow, to a continued stable source of tax revenue, to the continuation of well-established industrial activities and to the preservation of fish and game. The owner’s responsibility lies in the economic returns which he enjoys through harvesting the timber.

As early as 1911 the Federal Government recognized in part its responsibility in the passage of the Weeks Law. This law restricted Federal cooperation to the protection of the headwaters of navigable streams, although a very broad interpretation was placed on what constituted a navigable stream. The law further limited Federal recognition of protective effort to funds that were appropriated and expended by the state. No recognition was given private expenditures made through the provisions of the Oregon fire patrol law, regardless of state administration in the expenditure of such funds.

Needs for broadening the provisions of the law and for further outlining a definite Federal forest policy, fixing the responsibility of each cooperating party, led to the appointment by Congress in 1923 of the “Select Committee on Reforestation.” This congressional committee held hearings in all the important timber centers in the United States, and secured information which led to the passage of the Clarke-McNary Act in 1924.

The Clarke-McNary Law is a definite statement of policy on the part of the Federal Government, indicating just how far it will go in promoting better management of private and state-owned forests. It assumes, naturally, that forest lands must be kept continually producing and that the primary requisite to meet this condition is adequate fire protection. The law not only directs the Secretary of Agriculture to assist states in organizing and developing forestry departments but goes further and instructs him to cooperate with them financially when he finds the state system of protection and suppression promotes the objects of the act.

The state of Oregon has received this Federal cooperation under both the Weeks Law and the Clarke-McNary Law. For the federal fiscal year of July 1, 1928, to June 30, 1929, the state will receive a total allotment of $65,012.

Depredations of the bark beetle in the yellow pine forests of Klamath and Lake counties caused damage to an alarming extent as early as 1911, but owing to lack of state legislation
DISTRICT WARDEN'S HEADQUARTERS—North Fork Station, Clackamas County
necessary to carry on control work and to the inability of private, state and federal agencies to cooperate in the work, nothing was done at the time. However, the forest insect epidemic became so serious during 1918 and 1920 that concerted action on the part of all interested agencies became imperative. Timber owners secured the passage of a state law declaring pine beetles a pest and providing methods of control and eradication on privately owned timber lands. Congress was induced to provide an appropriation of $150,000 to carry on the work on federal lands. Owing to the intermingled ownership of lands it was necessary that control work be carried on simultaneously, inasmuch as a non-treated infected area would be a source of infestation for adjacent lands. Cooperative agreements were drawn up and under these the three organizations conducted the work during the years 1922, 1923 and 1924. Federal funds were then exhausted and efforts to get Congress again to appropriate funds for control purposes have been unavailing. However, in spite of the failure of the Federal Government to continue the project, considerable work is still being done by private interests. While this work has been a success, adjacent, untreated areas of federal lands will be a source of reinfection to private-owned treated lands. Federal cooperation in insect-control measures should be continued.

Federal funds to the amount of $2,000 per year are allotted to match an equal amount provided by the State Board of Forestry in establishing and operating a forest nursery. This nursery, located near Corvallis, has a present capacity of 500,000 tree seedlings annually. The planting stock is distributed among the ranchers of the state for the establishment of woodlots and shelterbelts. Through this means, the Federal Government hopes to increase the total amount of valuable wood material in the state as well as to assist the farmers in insuring a convenient supply of wood for farm use.

State Forest

The state of Oregon has made a beginning in the acquisition of a state forest. By act of congress, scattered school lands were exchanged with the Forest Service for a compact body of forest land lying south of the mouth of the Umpqua river. This tract aggregates 77,000 acres in area. It is located in one of the best timber growing sections on the coast. All forest conditions, from small stuff to mature trees, are present. It is a valuable property and, in addition to producing timber crops, can be made a laboratory for conducting experimental forestry work which should prove of great value to the future forestry program of the state.
VIEW OF LOGGING OPERATION FROM THE AIR

-Photo by Brubaker Aerial Surveys, Portland, Oregon
Forest Taxation

The present system of taxing forest properties in Oregon must be radically revised if private enterprise is to play any considerable part in the forestry game of the future. The general property tax, broadly speaking, assumes that the property to which it is applied yields an income annually from which taxes as well as other yearly costs can be met. Forest properties yield an income but once in a lifetime. Under the favorable conditions west of the Cascades, 60 years appears to be the shortest feasible rotation for saw timber. Material suitable for pulp-wood could possibly be produced in 35 years. To tax growing forest crops annually under the general property tax, is nothing short of confiscation. The owner's interest in the growing crop may be completely absorbed by repeated tax exactions. Equity demands that there shall be some fair proportion between the amount of the tax collected during the growing crop period and the value of the forest crop when it is harvested.

The most equitable form of forest tax as far as the forest owner is concerned, would be a levy upon the final crop when removed, and at no other time. The tax could be expressed as a certain per cent of the gross value of the final yield. While such a tax would place the owner in the most favorable position because he would have no tax to pay until he had income to pay it, the plan would be decidedly unfavorable to local taxing units because they would be deprived of tax money until the forest crop should mature, thus providing tax incomes in uncertain amounts and at uncertain times.

To meet in part the requirements both of owners and of taxing organizations, a compromise plan has been suggested. This provides for a low annual tax to be levied upon the land alone regardless of any accumulated values in the form of growing wood products. This would insure to local tax units in forested counties a constant tax income while the burden upon the owner, in advance of income from his forest crop, would be comparatively light. In addition to the annual tax, a tax in the form of a per cent of the gross yield would be levied when the timber was sold or removed. The annual tax, accumulated to the time of harvest, plus the yield tax, should represent a sum which should be in proportion to the sum of the taxes levied upon property of equal value under the general property tax during the same period.

The whole question of forest taxation should be given the most careful consideration by the citizens of Oregon. As has been indicated, a proper solution of the forest tax problem is vital to the continued participation of private enterprise in timber production. To the degree in which the continued par-
Many Oregon cities derive their supply of water for domestic use from forested areas. In the majority of cases, this land is privately owned. In many instances, private owners are cutting the timber and as a result the quality of the water is impaired and the efficiency of the watershed is reduced by the lessened stream flow during the dry season, the period of greatest need. The Federal Government has recognized the value of a forest cover on a city watershed, notably in the case of Portland. Bull Run water has acquired fame throughout the nation. In a lesser degree, the government has assisted cities in maintaining a forest cover on the areas from which this water is obtained in the cases of Dallas, Corvallis, and McMinnville, where tracts of government lands have been set aside for municipal purposes. These are small beginnings. Before it is too late, Oregon cities having possibilities of securing water supplies from forested areas should be fully impressed with the desirability of safeguarding those tracts by purchase. They should be advised by the office of the State Forester, or by the School of Forestry at the Oregon Agricultural College, or both, relative to the areas required and the methods of management after acquisition. A general state law, giving cities the right to condemn and purchase lands needed for watershed purposes, should be enacted. European cities derive revenues from their municipal forests far in excess of the costs of management. In addition, they have the benefits coming from a safeguarded water supply. Certain Oregon cities should own and manage forests on their watersheds. Every year of delay means an added cost when the property is finally acquired.
OREGON'S FORESTRY LAWS
A BRIEF SUMMARY

The forestry laws of Oregon are under the general administration of the State Board of Forestry. The Governor of the state and the head of the School of Forestry of the State Agricultural College are members of the board. Five additional members are appointed by the Governor, one each upon the recommendation of the following: The Oregon State Grange, the Oregon Forest Fire Association, the West Coast Lumbermen’s Association, the United States Forest Service, and the Oregon Woolgrowers’ Association. The board is absolutely nonpartisan in character.

The State Board of Forestry appoints a State Forester, who has immediate charge of carrying out the provisions of the state forestry laws. The State Forester’s office is in the Capitol building at Salem.

The State Forester, acting under the general policies approved by the State Board of Forestry, has the following duties: He appoints fire wardens, and supervises their work; collects information relative to forest conditions; enforces the law relative to preventing and fighting forest fires; prosecutes violators of the forestry laws; cooperates with landowners in forest protection; advises and encourages reforestation; designates fire protection districts; and indicates areas of forest insect infestation.

Any inadequately protected forest land which is covered wholly or in part by inflammable debris and which constitutes a menace to life or property is a public nuisance. The State Forester is compelled by law to take such steps, by burning or otherwise, as may be necessary to insure public safety. The costs for doing the required work may be assessed against the owner of the property.

State fire wardens have the authority of peace officers to make arrests for violations of the forest laws. Any warden who fails to perform his duties is subject to fine or imprisonment, or both.

Able-bodied men, when called upon by a fire warden to do so, must aid in suppressing forest fires. A fine may be imposed for refusal to comply.

May 15 to October 1 is designated by law as a closed fire season. During this period areas covered with slash or brush may not be burned over unless a permit for burning has been given by a fire warden. Violations of this regulation are punishable by fine or imprisonment.
During seasons of unusual drouth, the governor may by proclamation suspend all burning operations. He may also close the forests to hunting if in his judgment the public safety demands such action.

One may be fined or imprisoned for setting fire on the land of another, or letting fire escape, wilfully, or accidentally, from his land to that of another.

It is unlawful to leave a camp fire burning, or to make a camp fire without first clearing the ground about it of inflammable debris. Violation of this provision is punishable by fine or imprisonment.

Forest or brush fires burning uncontrolled are, by law, a public nuisance. Persons responsible for such fires are required to make reasonable efforts to put them out. If they
fail to do this, State Forest officers may do the necessary work and charge the cost against the responsible persons. Such charges constitute a lien upon the property involved.

During the closed season all engines operating in or near forest or brush land must be equipped with effective spark arresters, must have water under pressure, and must have at least 200 feet of hose.

The slash which accumulates during any year of logging or other woods operation must in that year be removed by burning or else must be fire-proofed in such manner as may be approved by the State Forester.

It is against the law, during the closed season, to throw away any lighted tobacco, cigars, cigarettes, matches or other lighted material, on any forest land, private road, public highway or railroad right of way.

The destruction of notices posted by authority of the State Board of Forestry or of the Federal Forest Service is expressly forbidden by law.

Every owner of timberland must provide sufficient fire patrol for it during the fire season. Such patrol must be approved by the State Board of Forestry. If the owner fails to provide such patrol the State Forester shall provide it and shall charge the cost to the owner of the land, such charge becoming a lien upon the property, to be collected in the same manner as taxes are collected.

Timberland to the extent of 160 acres is deemed to be adequately protected if more than one-half the acreage lies within one mile of the owner’s permanent residence.

County judges are ex-officio fire wardens and may issue or revoke burning permits during the fire season, but every person securing such a burning permit must, at least 24 hours before burning, give notice to each resident owner of adjoining land of the time when he intends to burn.

Forest insects harmful to standing timber are, by law, a public nuisance. Sixty per cent or more of the owners of timberland in a region infested by forest insects may ask the State Forester to have the infested area designated as an infestation district, and to take the necessary steps to eradicate the insect pests. Owners refusing to cooperate in this work shall have a proportionate part of the cost charged against their property. Failure on the part of any owner promptly to pay this charge shall result in the sale of the property by due process of law and a sufficient amount of the proceeds shall be appropriated to cover the cost of the insect eradication work.

The State Board of Forestry is empowered by law to accept, in the name of the state of Oregon, gifts of lands which may be suitable for forestry purposes.
"Beside the Still Waters"
THE OREGON REFORESTATION LAW

The presence of an immense natural resource such as timber has almost universally tended toward an attitude of indifference on the part of the public. Not until timber famine has become an actual fact have any definite and aggressive steps been taken to remedy the situation. Oregon went contrary to all custom when the thirty-fifth legislature, which convened in Salem on January 14, 1929, passed one of the most progressive reforestation laws that has ever received favorable consideration of any legislature.

The outstanding feature of the Oregon law and one wherein it differs from any reforestation law now on the statute books of any state, is in the automatic classification of all lands that come within the definition of "reforestation lands." Forest economists have held that this one feature is essential to the complete success of any reforestation law. Under the Oregon law, it is the inherent character of the land that determines its classification, not the wishes of the owner. The law states that reforestation land means any land more suitable for the growing of timber crops than for any other purpose, but upon which timber is not now present in merchantable quantities. When the lands are so classified by the State Forester and the order finally issued, they become subject to the provisions of the law regardless of the wishes of the owner. This is also in strict compliance with the constitution of the state which provides that lands may be taxed according to classification but there must be no variation within each classification as regards taxation. Therefore, all lands in the state that meet the requirements of reforestation lands become subject to the provisions of the law as soon as they can be classified and their status definitely fixed on the records of the respective counties in which the lands are situated.

Classification of the lands presents a problem. In many instances, such as typically forest land where the timber has been removed, there can be no question as to the classification, but in the marginal areas will arise serious questions as to land use. Is it best suited for agriculture, grazing or some other purpose? Another situation will arise in many instances as to the determination of merchantable values. There are many acres of second growth timber in Oregon ranging from the very small trees to merchantable timber. What shall determine the dividing line? Some counties are now assessing this on the basis of this timber. These counties saw the possibility of a serious reduction in their tax base through land classification and in order to definitely assure them that it was not the policy of the state board to classify any lands as reforestation lands where the tax income to any county would
be seriously affected, a provision was placed in the law whereby such lands could not be classified as reforestation lands without the consent of the county court. There is nothing arbitrary in the classification of the lands and the owner has every right to be heard or to appeal to the courts of the state from any decision of the board or tax commission which he considers might affect him adversely.

Immediately the board determines what lands are to be classified as reforestation lands, a hearing is held in the county in which the lands lie, at which time any interested individual as well as county officials may present arguments for or against the classification. These records are submitted to the state tax commission for consideration and the order finally issued either for or against the classification. If the decision is for the classification, the lands are then placed on a separate roll by the assessor of the county and immediately become subject to the provisions of the law.

The revenues accruing to the counties under the law consist of a flat forest fee of five cents per acre and a yield tax of 12.5 per cent at maturity or when harvested. The term “forest fee” instead of “tax” is used in order to get away from the idea that it is in any way a tax. Objections have been raised to putting a flat tax of a definite sum per acre on all classes of forest lands regardless of their productive capacity. Reforestation lands when so classified are subject to no fees or taxes other than the forest fee and the yield tax. No special road district tax, port tax, or taxes of similar nature can apply to reforestation land as long as it remains in that classification. However, all improvements and values other than forest values can be taxed under the ad valorem tax laws of the state. Immediately the timber becomes mature it becomes subject to the ad valorem tax that applies to all property in the state and remains so subject until harvested. Delay of the owner in cutting the timber in no way nullifies the 12.5 per cent equity the county holds in the timber. It must be paid whenever the timber is cut.

No forest crop can be harvested without a permit from the board and the permit must state the unit value of the forest crop to be removed. The board’s action in this matter is not final, for any individual has the right of appeal to the courts of the state. In order to prevent delay in harvesting in case an appeal is taken, the owner may file a bond and go ahead with his logging activities. During harvesting the owner must keep records of all crops harvested and semi-annually report to the county treasurer, reporting the amount removed and also submit payment of the yield tax due at that time. No law can force an individual to pay taxes before they are due. The yield tax under the law is not due until the
crop is removed and hence there is the possibility of a financially irresponsible party removing the crop and failing to pay the tax. In order to prevent this, the state can require the owner to post a bond prior to harvesting, sufficiently large to protect the county's interest in the crop.

Under any law it is almost certain that certain abuses will creep in and the reforestation law is no exception. An owner may have his land classified in order to get reduced taxation, where he is being taxed on some basis other than the timberland. Again an owner may have his land classified and then use it for some purpose other than timber growing, such as grazing and then burning annually in the belief that grazing is improved. Under such conditions, the classification of the lands could be canceled and the lands not only be subject to the regular ad valorem taxes, but any ad valorem taxes in excess of the five cents per acre forest fee which might have been paid during the classification period immediately become due with the same penalty and interest that apply to other taxes. This applies only to land abuse and not where some unforeseen value arises such as increased value through desirability for a town site.

The contractual feature is also included in the law but this is not made effective until July 1, 1933. One reason for the delay was because of the fact that the federal forest tax inquiry has not yet been completed and it is desired to get the results of this study before making the contractual feature effective. Furthermore, some flaws might develop within the next few years which might demand legislative changes.

The situation in Oregon is ideal for the adoption of a definite reforestation policy. The state contains more merchantable timber than any other state in the Union. While there is a considerable area of denuded forest land, nevertheless it has not yet become a serious problem in so far as it affects the general economic welfare of the state. There is a large supply of timber with no threat of a famine for many, many years. The area of privately-owned denuded forest land is relatively small. There is a wonderful opportunity for embarking upon a policy that will insure a definite sustained yield. The conditions are ideal and the state has indorsed that policy through the passage of legislation that will encourage the private owner to retain title to his cut-over forest land. This is in direct opposition to most states where reforestation laws have not been passed until the forests have been stripped of their timber, towns and counties impoverished through removal of mills and the entire state suffering from the loss of tax revenue. The adoption of the law in Oregon will be one great step in preventing any severe economic disturbance in the transition from the old forests to the new.
THE ORIGINAL FORESTED AREA of the United States is estimated to have been 822,000,000 acres. This area has been reduced to 469,000,000 acres. A considerable part of this remaining acreage has been culled of its best timber.

The original saw timber stand of the United States has been estimated at not less than 4,200 billion board feet. This has been reduced to about 2,215 billion board feet, approximately 40 per cent of the original stand.

About three-fourths of the total present stand of timber, including the best and most accessible, is in private ownership. Less than one-fourth is included in the National Forests. The remainder, about 3 per cent, is owned by states and municipalities.

The average consumption of saw timber in the United States is approximately 40 billion board feet. If this rate continues our present stand will be exhausted in about 50 years.

The people of the United States are using their timber four times as fast as growth replaces it. European countries cut no more each year than they grow. In the United States there is an ample area of land, good for nothing except to grow trees, to produce all the timber we need for all purposes, for all time. The unproductive part of this area should be put to work and kept at work growing trees.

The railroads of the United States expended over $100,000,000 for cross-ties in 1926.

Over 44 per cent of the lumber used in the United States was shipped from Oregon, Washington and California in 1926. For the same year the per capita consumption of lumber was reckoned at 305 board feet.

For the year 1926 the Forest Service records show there were 91,793 forest fires which caused a direct damage of $26,900,000.

The city of Zurich in Switzerland has owned a forest for a thousand years. For more than six hundred years under careful management, the forest has yielded a crop of wood each year and today it is in better condition than ever before.

Oregon has 395,800 million feet of saw timber. This is more than one-fifth of the remaining stand in the United States.

Douglas fir is the most valuable timber tree in the United States. In Washington and Oregon this tree makes up over 500 billion feet of the total stand, or nearly one-fourth of the remaining timber in the whole country.
Waste and worthless land is worse than a dead loss. It is a drag on the community. Idle land leads to decline in industry, wealth, population, and public revenues. It depresses agriculture and causes social retrogression. Permanent prosperity must be based on permanent resources, fully and wisely used. Timber growing must be the mainstay of regions in which this represents the highest use to which the bulk of the land can be put.

Oregon stands second among the states in lumber production. The 1925 cut was 4,216,000,000 feet, board measure. The manufactured value of this lumber exceeded $100,000,000. A total of 47,000 persons were employed by the industry, representing 65 per cent of the state's industrial payroll.

Forest industries and standing timber pay about one-third of the taxes in Oregon. In some counties timber pays as high as 75 per cent of the taxes, and in others over 50 per cent.

An average acre of Douglas fir land in western Oregon will produce 41,000 feet of saw timber in 60 years. In terms of fuel it will grow over 100 stacked cords of wood in the same period.

In favorable locations, Douglas fir stumpage has sold for $4 per thousand board feet. Western yellow pine stumpage in the Klamath region has sold for more than $8 per thousand board feet. In New England, white pine stumpage has sold for better than $20 per thousand. Thirty years ago white pine stumpage could be bought for a lot less than $4 per thousand and Douglas fir for about 10 cents per thousand. It is interesting to speculate on the price of Douglas fir stumpage 30 years hence.

Forest experts estimate that a thousand feet of saw timber can be grown in western Oregon on land seeded by nature for not more than $7. Nonagricultural lands covered by second-growth have a decided future value.

Fire is the great enemy of second-growth. In the United States there are 240,000,000 acres of cut-over land. Fire burns over from 8 to 10 million acres of this land annually. Oregon contributes its share in this needless destruction.

Oregon has a little state forest of 77,000 acres. This is the beginning of something which should develop eventually into a full-grown forest, that will be worthy of the greatest forest state in the Union.
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